



bulletin

of the international society of soil science

bulletin

de l'association internationale de la science du sol

mitteilungsblatt

der internationalen bodenkundlichen gesellschaft

Edited and published by / rédigé et publié par / redigiert und publiziert von:

**INTERNATIONAL SOCIETY OF SOIL SCIENCE
ASSOCIATION INTERNATIONALE DE LA SCIENCE DU SOL
INTERNATIONALE BODENKUNDLICHE GESELLSCHAFT**

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Season's Greetings
Meilleurs Vœux
Beste Glückwünsche

STOP-PRESS!

To avoid hardship to participants due to price hikes, the India Tourism & Development Corporation has agreed to give a discount of 20 percent on the official new tariff rate of the hotels.

La Société indienne du tourisme et développement a accepté d'accorder aux participants une remise de 20 pourcent sur les nouveaux tarifs des hôtels pour éviter des inconvénients à cause des augmentations des prix.

Der 'India Tourism and Development Corporation' hat auf die offizielle neue Hotel Tarifraten einen Preisnachlass in Höhe von 20 Prozent zugestimmt, um den Kongressteilnehmern vor Unangenehmlichkeiten in Folge neuerlicher Preiserhöhungen zu hüten.

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FINAL INFORMATION ON THE 12TH INTERNATIONAL CONGRESS OF SOIL SCIENCE

In the previous announcement we have give enough information about the 12th International Congress of Soil Science, which will be held at New Delhi from February 8-16, 1982. Here is some additional information and changes which become inevitable because of sudden escalation of prices and other factors. Intending participants may like to note these.

1. The venue of the 12th Congress is VIGYAN BHAVAN, NEW DELHI.
2. The Jawaharlal Nehru University, New Delhi has taken the contract for providing simultaneous translation in French and German, but we request to use English language as much as possible.
3. The invited papers for Symposia and Panel discussions are being pre-printed for distribution to registered participants. Only abstracts of the voluntary papers will be available for distribution.
4. Only those scientists who register themselves in time on payment of full registration amount will be authorised participants. The registration fee is NEITHER REFUNDABLE NOR TRANSFERABLE.
5. Only those authors who have registered themselves will be eligible to present papers. NO paper will be presented by PROXY.
6. Due to rise in prices, the ITDC has revised the hotel tariff rates, which will be applicable for the Congress participants. The participants should make a note of this change. The Organizing Committee will help in making shifts from higher priced to medium priced hotels, but the seats are limited and first come first served principle will be followed. If a group of scientists has preference for some hotel, they have to notify their intent earliest and back it up with deposit.
7. All participants are required to obtain valid and international health certificates, passport, and visa for entry into India. They will be met at Delhi airport provided arrival schedules are communicated well in time.
8. Any special dietary requirements should be communicated to the Organization/Hotel in advance.
9. The last date payment of Registration fee and deposit for hotels and tours is 30TH NOVEMBER 1981. Participants are requested to expedite payment of the dues to enable the Organizing Committee to make arrangements.
To avoid embarrassment and delays the payments should be made by bank draft on State Bank of India to the Organizing Secretary, 12th International Congress of Soil Science, IARI, New Delhi: 110012.
10. Light warm clothing will be ideal but participants should be prepared to face fluctuations of weather.

Post-Congress Tours

Owing to poor reponse to TOUR NO. 4, Delhi-Khajuraho-Varanasi-Khatmandu it has been DROPPED. Participants who had intended to take this tour may indicate their second and third preference if they have not done so.

Dr. N. N. Goswami, Secretary Organising Committee 12th ISSS Congress,
Div. of Soil Science & Agric. Chemistry,
I.A.R.I, New Delhi 110012, India.

DERNIÈRE INFORMATION SUR LE DOUZIÈME CONGRÈS INTERNATIONAL DE LA SCIENCE DU SOL

Notre annonce précédente contenait ample information sur le douzième Congrès international de la science du sol que se tiendra à New Delhi, le 8-16 février 1982. Le suivant donne quelques renseignements supplémentaires et des changements, qui sont inévitables à cause des prix galopants et d'autres facteurs. Des personnes désireuses à participer sont priées d'en prendre note.

1. Le lieu du douzième Congrès est VIGYAN BHAVAN, NEW DELHI
2. L'Université Jawaharlal Nehru à New Delhi a été contractée pour s'occuper de l'interprétation simultanée en français et en allemand. Cependant, les conférenciers sont priés de se servir de la langue anglaise autant que possible.
3. Les communications sollicitées pour des Symposia et des Colloques sont en voie d'être imprimées en avance pour distribution aux participants enrégistrés. La distribution des communications volontaires ne sera que sous forme d'abstrait.
4. Seulement les membres, qui se font inscrire à temps en payant la somme entière d'inscription seront des participants autorisés.
Les frais d'inscription ne sont NI REMBOURSABLES NI TRANSFÉRABLES.
5. Seulement les auteurs, qui se sont inscrits seront éligibles à présenter des communications. Aucune communication sera présentée par 'PROXY'.
6. A cause de l'augmentation des prix, la ITDC a révisé les tarifs d'hôtel qui s'appliquent aux participants au Congrès. Les participants devraient pendre note de ce changement. Le Comité Organisateur aidera aux transferts des hôtels assez chers aux hôtels à prix abordables, mais les places sont limitées et ceux qui arrivent les premiers seront servis les premiers. Si un groupe de personnes a préférence pour un hôtel déterminé, ils doivent communiquer leur désir aussi tôt que possible et le confirmer en versant un acompte.
7. Il faut que tout participant soit muni de certificat international valable de vaccination et une visa d'entrée à l'Inde. Les participants seront accueillis à l'aéroport Delhi à conditions que les heures d'arrivée soient communiquées bien en avance.
8. Les participants qui doivent suivre un régime sont priés de le communiquer à l'Organisation/Hôtel en avance.
9. La dernière date de paiement des frais d'inscription et des acomptes pour des hôtels et des excursions est LE 30 NOVEMBRE 1981. Les participants sont priés de virer les montants dûs sans retard, pour que le Comité Organisateur soit en mesure de prendre des dispositions nécessaires. Afin d'éviter d'embarras et des retards, les paiements devraient être faits par chèque bancaire, tiré sur le 'State Bank of India' en faveur du 'Organizing Secretary 12th International Congress of Soil Science, IARI, New Delhi 110012'.
10. Des vêtements légers et chauds seront idéaux, mais participants devraient être prêts à faire face aux fluctuations climatiques.

Excursions post-Congrès

Vue la réponse maigre à L'EXCURSION NO. 4, Delhi-Khajuraho-Varanasi-Khatmandu, celle-ci a été ANNULÉE. Les participants qui avaient désiré de faire cette excursion peuvent indiquer leur deuxième et troisième préférence, s'ils ne l'ont pas encore fait.

Dr. N. N. Goswami, Secr. du Comité Organisateur du 12ème Congrès de l'AISS,
Div. of Soil Science and Agric. Chemistry,
IARI, New Delhi 110012, India.

LETZTE MITTEILUNGEN ZUM 12. INTERNATIONALEN KONGRESS FÜR BODENKUNDE

In der vorigen Ankündigung haben wir ausreichende Informationen zum 12. Internationalen Kongress für Bodenkunde erteilt, der vom 8.–16. Februar 1982 in Neu Delhi abgehalten werden wird. Hier finden Sie noch zusätzliche Meldungen und Änderungen, die auf Grund plötzlicher Preissteigerungen und anderer Gegebenheiten unausweichlich geworden sind. Sie dürften für voraussichtliche Besucher von Interesse sein.

1. Der Tagungsort des 12. Kongresses ist VIGYAN BHAVAN, NEW DELHI
2. Die Jawaharlal Nehru Universität hat die Simultan-übersetzung für Französisch und Deutsch vertragsweise übernommen; wir ersuchen die Sprecher jedoch, nach Möglichkeit die englische Sprache zu verwenden. Die Beiträge zu den Symposien und Diskussionen, die auf Einladung erfolgen, werden im Voraus gedruckt und an die eingeschriebenen Teilnehmer ausgegeben. Von den eingesandten Beiträgen werden nur die Kurzfassungen (Abstracts) zur Verteilung kommen.
4. Als offizieller Teilnehmer gilt nur, wer sich durch Bezahlung der gesamten Teilnehmergebühren rechtzeitig angemeldet hat. Die Teilnehmergebühren wird **WEDER RÜCKERSTATTET NOCH IST SIE ÜBERTRAGBAR**.
5. Nur offizielle Teilnehmer kommen zur Präsentation von Beiträgen in Betracht. Die Vorträge können **NICHT IN VERTRETUNG** gehalten werden.
6. Auf Grund von Preiserhöhungen hat das ITDC die für die Kongress Teilnehmer angebotenen Hoteltarife korrigiert. Wir bitten die Teilnehmer, diese Änderungen zu beachten. Das Organisations Komitee ist Ihnen behilflich, wenn Sie in ein preisgünstigeres Hotel überwechseln wollen, doch sind die Plätze beschränkt und Änderungsaufträge werden in der Reihenfolge ihres Eintreffens behandelt. Sollten mehrere Teilnehmer gemeinsam in irgendeinem Hotel wohnen wollen, müssen Sie Ihre Absicht unverzüglich bekanntgeben und durch Ihre Anzahlung bekräftigen.
7. Alle Teilnehmer müssen für die Einreise nach Indien im Besitze von gültigen internationalen Gesundheitszeugnissen, Reisepass und Visum sein. Sie werden am Flughafen Delhi empfangen, sofern die Ankunftszeiten rechtzeitig bekannt gegeben werden.
8. Eventuelle Diätvorschriften müssen den Veranstaltern bzw. Hotels im Voraus bekannt gegeben werden.
9. Einzahlungsschluss für die Teilnehmergebühr sowie die Anzahlungen für Hotels und Studienreisen ist der 30. November 1981. Die Teilnehmer werden ersucht, diese Einzahlungen rasch vorzunehmen, damit das Organisations Komitee die nötigen Verkehren treffen kann. Um Irrtümern und Verzögerungen vorzubeugen, sollten alle Einzahlungen durch Banküberweisen an die State Bank of India zu gunsten des Organisations-Sekretariats des 12. Internationalen Kongresses für Bodenkunde, IARI, New Delhi 110012, erfolgen.
10. Leichte, warme Bekleidung ist empfehlenswert doch sollten die Teilnehmer auch mit Witterungsschwankungen rechnen.

Studienreisen im Anschluss an den Kongress

Die Exkursion Nr. 4 (Delhi-Khajuraho-Varanasi-Khatmandu) wurde wegen zu niedriger Teilnehmerzahl gestrichen. Teilnehmer, die an dieser Exkursion teilnehmen wollten, mögen – falls noch nicht geschehen – Ersatz Exkursionen in der Reihenfolge ihrer Wahl angeben.

Dr. N. N. Goswami Sekr. des Organisations Komitees 12. Kongress der IBG,
Division of Soil Science & Agric. Chemistry,
IARI, New Delhi 110012, India.

REPORT OF THE SECRETARY-GENERAL 1978-1981

In compliance with the new Rules of the Society, the report of the Secretary-General over the period since the last Congress (Edmonton, Canada) is printed in this Bulletin, being the last issue prior to the new Congress (New Delhi, India).

Membership

The number of members rose from 5416 in June 1978, directly before the Edmonton Congress, to 6115 in October 1981; they reside in 127 countries. In-between, a peak of about 7050 members was reached (cf. Membership List 1979/1980). At the insistence of the Treasurer, who keeps the membership records, a considerable number of names was subsequently deleted because of non-payment of membership fees. In part this was due to currency transfer problems, but in many cases plain negligence was involved. The forwarding of separate reminders being too expensive, the Treasurer will henceforth include 'last warning' sheets in the appropriate issue of the Bulletin. In general, this holds for any member with arrears of more than one year, with some leniency for countries with known currency transfer problems, or where National Societies are as yet inexistent. Transfer of the combined fees over several years and through the National Societies will be stimulated, to avoid excessive bank-charges.

A growing number of National Societies work towards an automatic linkage between their own and ISSS memberships (Denmark, Nigeria, Norway, Spain, a.o.) and this is much welcomed.

The number of National Societies increased from 51 in 1978 to 54 in 1981, with the return of the Soil Science Society of China as a salient feature. The Secretariat is stimulating the formation of National and Regional Soil Science Societies in a number of countries in Africa, Latin America and Asia, as a means to promote the local advancement of soil science and its applications to agro-economic development.

During the past three-and-a-half year a number of members passed away, and several of them were honoured in the In Memoriam section of the Bulletin. Amongst them were several who had contributed greatly to the activities of the Society over many years and had therefore received a Honorary Membership: Dr. C. E. Kellogg (USA); Prof. Dr. M. M. Kononova (USSR); Prof. Dr. S. Mattson (Sweden); Prof. Dr. F. Scheffer (FRG); Prof. Dr. A. A. Rode (USSR), and Mr. L. Vettori (Brasil). Special mention may also be made of the passing away of Prof. Dr. L. D. Baver (USA); Dr. C. R. van der Merwe (S.A.); Prof. Dr. V. Ponomareva (USSR); Dr. G. D. Smith (USA), and Prof. Dr. L. Wiklander (Sweden), all significantly instrumental in the advancement of soil science during the past decennia.

Activities of Commissions and Working Groups

Quite a number of official Inter-Congress Activities took place, as follows:

- | | | |
|----------|-------|---|
| August | 1979: | 7th International Colloquium on Soil Zoology – New York, USA (<i>Commission III</i>). |
| August | 1979: | 7th International Symposium 'Humus et Planta' – Brno, Czechoslovakia (<i>Commission II</i>). |
| November | 1979: | International Symposium on the Stability of Spruce Forest Ecosystems – Brno, Czechoslovakia (<i>Working Group FS</i> , with IUFRO and Unesco-MAB). |
| February | 1980: | International Symposium on Principles and Practises of Reclamation of Salt-affected Soils – Karnal, India (<i>Subcommission A</i>). |
| June | 1980: | International Symposium on Soil Information Systems, Remote Sensing and Soil Survey – Purdue, USA (<i>Working Groups DP and RS</i>). |

July	1980:	International Conference on Soil Conservation – Silsoe, England (<i>adhesion Commissions I and III</i>).
August	1980:	International Symposium on Soil Physics Concepts on a Field scale – Budapest, Hungary (<i>adhesion Commission I</i>).
September	1980:	4th European Clay Conference – Munich, FRG (<i>adhesion Commission VII</i>).
November	1980:	International Workshop on Land Evaluation for Forestry – Wageningen, the Netherlands (<i>Working Group LE</i> , with IUFRO).
January	1981:	2nd International Symposium on Acid Sulphate Soils – Bangkok, Thailand (<i>proposed Working Group AS</i>).
February	1981:	International Conference on Soils with Variable Charge – Palmerston North, New Zealand (<i>Commissions IV, V and VI</i>).
April	1981:	International Conference on Aridic Soils, with a special section on Desertification – Jerusalem, Israel (<i>Commissions V and VI, and Working Group DS</i>).
May	1981:	3rd International Symposium on Remote Sensing for Soil Surveys – Warsaw, Poland (<i>Working Group RS</i>).
July	1981:	International Colloquium on Humus and Nitrogen – Reims, France (<i>adhesion Commission II</i>).
August	1981:	International Working Meeting on Soil Micromorphology – London, England (<i>subcommission B</i>).
September	1981:	International Symposium on Soil Problems in Urban areas – Berlin, FRG (<i>adhesion Commission III</i>).
September	1981:	International Colloquium on Earthworm Ecology – Merlewood, England (<i>adhesion Commission III</i>).
September	1981:	International Colloquium on the Handling of Soil Data – Paris, France (<i>Working Group DP</i>).

Summary reports on all these activities have been published in the ISSS Bulletin. Most of the meetings resulted in Proceedings published by the respective organizing Committees. Unfortunately, there is a tendency to limit these Proceedings to the papers of Plenary Symposia and Panel Meetings, with at best only the abstracts of session papers and poster papers. In several cases, too, there is no proper reference to ISSS involvement. In two earlier instances the publication of the Proceedings did not take place till four or more years after the event. Such facts are not only unpleasant for the participants themselves, but also result in a general disinterest to submit scientific papers of significant value to future ISSS meetings. Uniform publication of the full Proceedings of Commission and Working Group meetings by the Society (cf. suggestion in Secretary-General's 1974 report, Bulletin 54) would certainly be advantageous, but the limited manpower and funds of ISSS do not permit such an action. For the time being, the Executive Committee can only be instrumental in trying to find the right editor and Publishing House. The ISSS Council may want to insist that guarantees be given by the organizers of inter-Congress meetings that indeed the full Proceedings be published, and be published in time.

Several Working Groups had small or informal meetings, viz. those on Soil Fertility Testing (FT), on Nomenclature of Hydromorphic Soils (HS), on Paleopedology (PP), on Forest Soils (FS), and on Soil Colloid Surfaces (CO). Some others were apparently dormant, or did not bother to inform the Executive on their activities.

Three approved Commission meetings were either cancelled or postponed, viz. the Meeting on Biological Transformation of Organic Matter (Czechoslovakia – Commission III), the Symposium on Soil Problems associated with Irrigation in Arid Steppe and Savannah Regions (Ghana or USSR – Commission VI) and the Sympos-

sium on the Soils of the Humid Tropics of Africa and their Management (Ghana – Commissions IV, V and VI).

Noteworthy regional events in soil science were however:

- | | | |
|----------|-------|--|
| June | 1979: | International Meeting on Priorities for Alleviating Soil-related Constraints to Food Production in the Tropics – Los Baños, Philippines (IRRI and Cornell University). |
| July | 1980: | 7th Latin American Congress of Soil Science – San José, Costa Rica (Sociedad Latino-americano de Ciencia del Suelo). |
| October | 1980: | International Symposium on Paddy Soils – Nanjing, China (Soil Science Society of China). |
| November | 1980: | 1st Inter-African Soil Science Congress – Accra/Kumasi, Ghana (OAU Scientific, Technical & Research Commission). |

International Cooperation

Close cooperation was maintained with several of the United Nations specialised agencies, viz. FAO, Unesco and UNEP. This resulted in strong ISSS involvement in two major topics, broached by UNEP in particular. They are the elaboration of a World Soils Policy (meetings of March 1980 and February 1981, both at FAO, Rome), and the preparation of an International Reference Base for soil classification (meetings of May 1980 and June 1981, both in Sofia). Some other subjects were agroclimatology; land evaluation; soil degradation and desertification, and world soil mapping. The last explanatory text of the FAO/Unesco Soil Map of the World appeared in 1981. The documents resulting from this project, to keep serving their purpose, need to be kept up-to-date. All relevant new information is therefore being collected and assembled (cf. Bulletin no. 55). Discussions are underway with Unesco for a new edition of the map-sheets that were published first (1970, South America sheets).

ISSS cooperated with the International Union of Forestry Research Organizations (IUFRO) in the organization of International Workshops on Land Evaluation for Forestry and on the Stability of Spruce Forest Ecosystems (Working Groups LE and FS respectively). Working relations were maintained or established with the World Meteorological Organization (WMO); the International Atomic Energy Agency (IAEA); the United Nations Centre for Science and Technology for Development (UNCSTD); the International Council of Scientific Unions (ICSU), and its Scientific Committee on Problems of the Environment (SCOPE), its Committee on Water Research (COWAR), and its Committee on Science and Technology in Developing Countries (COSTED); the International Commission on Irrigation and Drainage (ICID); the International Council for Research in Agroforestry (ICRAF); the International Soil Tillage Research Organization (ISTRO); the International Geographic Union (IGU); the International Peat Society (IPS); the International Union of Quaternary Research (INQUA); the International Association for the study of Clays (AI-PEA); the *International Institute for Applied Systems Analysis (IIASA)*; the *International Federation of Institutes for Advanced Study (IFIAS)*; the Arab Centre for the Study of Arid Zones and Drylands (ACSAD); the Interamerican Institute of Agricultural Science (IICA), and the EEC Programmes on Land use and Rural Resources and Development Oriented Agricultural Research respectively. Also contacts were developed with several of the International Agricultural Research Centres of the CGIAR group, notably its International Service for National Agricultural Research (ISNAR). The same holds for several national entities with international activities like the Benchmark Soils Project (BSP) and the various International Committees created by the USDA-Soil Conservation Service for the improvement of the US Soil Taxonomy system of classification.

Financial Situation

The Treasurer has prepared Receipts & Payments accounts for the years 1978, 1979, and 1980 (see Bulletins 55, 57 and 59). The 1981 Account and the accumulated account over the four years will be presented by him to the ISSS Council in New Delhi.

The present membership fees do not even cover the costs of printing and dispatching of the Bulletins and Membership Lists. Only because of voluntary support at the offices of the Secretary-General, the Deputy Secretary-General and the Treasurer, and subsidies from various Dutch Government Institutions, can the day-to-day operations be maintained at its present level. No funds are available for supporting the activities of the Society's Commissions and Working Groups, or for the stimulation of participation by members from developing countries.

The Bulletin

Seven issues, of 72 to 80 pages each, were issued over the passed 3½ years, the average number of copies being 7000. Halfway the period, the facilities for commercial advertising had to be cancelled. Otherwise it would not anymore be possible to take advantage of relatively cheap dispatching from Ghent at a reduced postal rate. The total span-of-time between preparation of the copy text at Wageningen and the arrival of the Bulletin at members' addresses is now five to six months. Ways and means are being explored to shorten this.

Notwithstanding the precareous financial situation, much effort was put in maintaining the quality of the biannual bulletin at the level of the preceding period. *Special attention was given to the sections 'New Publications' and 'International Training Courses',* considering its usefulness for soil scientists in countries without easy access to such information. Also the section on 'International Relations' was expanded, in view of the need for concise information on the near overwhelming array of international programmes dealing with soils in one way or another.

There is growing demand to use also Spanish as a working language in the Bulletin.

Rules & By-laws

The Committee-on-Rules met formally in Ghent, Belgium, on June 29th, 1979, at which occasion the details of the approved New Rules were established. These were subsequently printed, and dispatched together with the Membership List 1979/1980 to all members.

At the Ghent meeting, during a subsequent informal meeting in Rome on March 5th, 1980, and through correspondence, a set of By-laws were formulated, for submission to the ISSS Council. These proposals were sent to all National Societies in February 1981 and were also printed in Bulletin no. 59.

As requested by the Edmonton Council, the Secretary-General settled on a final choice for an Emblem, after several informal consultations. The emblem will be added to the standard letter heads of the Society, to become of general application after the New Delhi Congress.

Representation

Officers of the ISSS took part in most of the inter-Congress activities of the Commissions and Working Groups, and represented the Society in a number of other international meetings (ICSU General Conference, FAO Conference, Unesco-MAB Conference, UNEP World Soils Policy meetings).

On the occasion of regional or national soils activities or during duty travels related to their own scientific institutions, the Secretary-General, the Deputy Secretary-General and/or the Treasurer visited Belgium, Bulgaria, China, Colombia, Costa

Rica, Czechoslovakia, England, France, Hungary, India, Indonesia, Kenya, Lebanon, Malaysia, New Zealand, Philippines, Syria, Thailand, USA. At such occasions personal contacts with National Societies were established, local soil scientists were stimulated to join ISSS, and membership fees were collected in local currency. Only very rarely these representations had to be charged to the sparse ISSS funds.

General

One subject continuously on the mind of the Executive was the creation of some formal international institution for the advancement of soil science and its agricultural applications, especially for developing countries. Reference be made to the unanimously carried resolution 2 of the Edmonton Congress, asking for the establishment of an International Soil Science Research Institute (ISSRI) within the framework of the CGIAR. Notwithstanding its active promotion by the Past-President Dr. C. F. Bentley, this idea was not favourably considered by the Consultative Group.

A second, less ambitious proposal, calling for an International Board of Soil Resources Management (IBSRM), was formulated at an international meeting of invited soil scientists in the Philippines, in June 1979, organized by IRRI and Cornell University. A provisional Steering Committee from among the participants formulated detailed goals and lobbied for initial financial support, without any tangible results thus far.

In the meantime, the International Soil Museum (ISM), a Centre for Research and Information on Soils of the World, finally opened its permanent premises in Wageningen, the Netherlands (see Bulletin no. 55). This institution is basically a joint undertaking of ISSS and Unesco, hosted by the Dutch Government. In view of the lack of financial response for the initiatives mentioned above, ISM may in fact be welcomed as a starting point for the much needed international development-oriented centre of soil science, after a broadening of its aims and a change-of-name. In close contact with ISSS and institutions like FAO and ISNAR, the Centre could, with a few more staff members, produce a directory of persons and institutions who are active in the field of soil science and its application; assemble and disseminate information on major soil-related research projects, and undertake relevant literature translation (cf. Secretary-General's 1974-1978 report).

The scope of soil science and its applications is ever increasing, as substantiated by the breadth and depth of subjects discussed during the inter-Congress period, and the variety of items recorded in the Bulletin. Of late, much attention has been given to the branch of soil cartography and classification (Commission V). The Society and its Bulletin should however strive to give due attention to *all* branches, even though some have their own newsletter (like Commission III's 'Pedofauna'). It should also be open to accommodate new developments, like the strongly increasing attention to soil conservation and soil-environmental-pollution. The inter-Congress conferences, with their manageable numbers of participants, are likely to gain further importance. They appear to be good opportunities for in-depth and interdisciplinary (i.e. inter-Commissional) discussions of major natural soil groups (salt-affected soils; aridic soils; variable-charge soils; hydromorphic soils; etc.). In addition, there is an increasing call for Workshop on new methods and techniques in the study of soil science (land evaluation; remote sensing; information systems; etc.). New concepts on the functions of Subcommissions and Working Groups may be needed as a consequence of these developments.

As pointed out in the Secretary-General's report of 1978 (Bulletin no. 54), the strength of our Society lies in its professional character and its individual membership. The Bureau hopes for an effective support of all members, and of the newly elected Officers of Commissions and Working Groups in particular, in promoting all aspects of soil science.

Present membership is still rather strongly concentrated in Western Europe and North America. Efforts should be increased to have more members from other geographical regions, notably Latin American, Africa and Asia. In general, it is hoped that the New Delhi Congress will stimulate the active interest of soil scientists of these regions in the affairs of the Society. Only in such a case can the International Society of Soil Science play its proper role in the advancement of the science in the world at large, and in ensuring that optimum use is made of the world's soils and land resources.

The Secretary-General wishes to acknowledge the pleasant and fruitful cooperation in the past period with the Deputy Secretary-General Prof. Dr. I. Szabolcs and with the Treasurer Dr. D. Gabriels. He also wishes to thank the Board and Staff of ISM in Wageningen for their effective support.

W. G. Sombroek

RAPPORT DU SECRETAIRE GENERAL 1978-1981

Conformément au nouveau règlement de l'Association le rapport du Secrétaire général sur la période depuis le dernier Congrès (Edmonton, Canada) est publié dans le présent Bulletin, qui est le dernier numéro à paraître avant le nouveau Congrès (New Delhi, Inde).

Affiliation

Le nombre des membres est passé de 5416 en juin 1978, peu avant le Congrès d'Edmonton, à 6115 en octobre 1981; ils résident en 127 pays. Dans l'intervalle un maximum d'environ 7050 membres était atteint (voir: Liste de membres 1979/1980). Sur les instances du Trésorier, qui tient les relevés d'affiliation à jour, un nombre important de noms était supprimé par la suite à cause du non-paiement des cotisations. En partie les problèmes de transfert de monnaie en étaient la cause, mais dans beaucoup de cas il s'agissait tout simplement de négligence. Puisque l'envoi des lettres de rappel séparées coûte trop cher le Trésorier inclura dorénavant des fiches de dernier avertissement dans le numéro approprié du Bulletin. En général, ceci s'applique à chaque membre avec des arriérés de plus d'un an, avec une certaine indulgence dans des circonstances où il y a des problèmes de transfert de monnaie ou il n'existe pas encore d'Association nationale. A fin d'éviter des frais de banque excessifs il est recommandé de payer des cotisations sur plusieurs années à la fois et par l'intermédiaire des Associations nationales.

Un nombre croissant des Associations nationales visent à une liaison automatique entre leur propre affiliation et celle à l'AISS (Danemark, Espagne, Nigéria, Norvège entre autres) et ceci est très bienvenue.

Le nombre des Associations nationales est passé de 51 en 1978 à 54 en 1981, avec comme événement saillant le retour de la Société chinoise de la science du sol. Le Secrétariat est en train de stimuler la formation des Associations nationales et régionales de la science du sol dans un nombre de pays en Afrique, en Amérique latine et en Asie, en vue de promouvoir le progrès local de la science du sol et de ses applications pour le développement agro-économique.

Pendant la dernière période de trois ans et demi certains membres sont décédés, et la mémoire de plusieurs entre eux a été honorée dans la section 'In Memoriam' du Bulletin. Parmi d'eux il y a quelques-uns qui avaient contribué de manière particulière aux activités de l'Association pendant beaucoup d'années et qui avaient été élus

Membres honoraires: Dr. C. E. Kellogg (EUA); Prof. Dr. M. M. Kononova (URSS); Prof. Dr. S. Mattson (Suède); Prof. Dr. F. Scheffer (RFA); Prof. Dr. A. A. Rode (URSS) et M. L. Vettori (Brésil). Une mention spéciale est faite ici également de la mort de Prof. Dr. L. D. Baver (EUA); Dr. C. R. Van der Merwe (Afrique du Sud); Prof. Dr. V. Ponomareva (URSS); Dr. G. D. Smith (EUA); Prof. Dr. L. Wiklander (Suède), qui avaient tous contribué d'une manière significative au progrès de la science du sol pendant les dernières décennies.

Activités des Commissions et Groupes de travail

Un nombre assez important d'activités inter-Congrès officielles ont eu lieu comme suit:

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| Août | 1979: | 7ème Colloque international de Zoologie du sol – New York, EUA (<i>Commission III</i>). |
| Août | 1979: | 7ème Symposium international 'Humus et Planta' – Brno, Tchécoslovaquie (<i>Commission II</i>). |
| Novembre | 1979: | Symposium international sur la Stabilité des écosystèmes de forêts de sapins – Brno, Tchécoslovaquie (<i>Groupe de travail FS</i> , en coopération avec IUFRO et l'Unesco-MAB) |
| Février | 1980: | Symposium international sur les Principes et pratiques de l'amélioration et l'aménagement des sols salins – Karnal, Inde (<i>Sous-Commission A</i>). |
| Juin | 1980: | Symposium international sur le Traitement informatique des données de sol, la Télédétection et la Cartographie des sols – Purdue, EUA (<i>Groupes de travail DP et RS</i>). |
| Juillet | 1980: | Conférence internationale sur la Conservation du sol – Silsoe, Angleterre (<i>adhésion Commissions I et III</i>). |
| Août | 1980: | Symposium international sur le Physique du sol, Notions à l'échelle de terrain – Budapest, Hongrie (<i>adhésion Commission I</i>). |
| Septembre | 1980: | 4ème Conférence européenne sur Argiles – Munich, RFA (<i>adhésion Commission VI</i>). |
| Novembre | 1980: | Colloque international sur l'Évaluation des terres à des fins forestières – Wageningen, Pays-Bas (<i>Groupe de travail LE</i> , en coopération avec IUFRO). |
| Janvier | 1981: | 2ème Symposium international sur les Sols sulfatés acides – Bangkok, Thaïlande (<i>Groupe de travail proposé AS</i>). |
| Février | 1981: | Conférence internationale sur les Sols d'échange variable – Palmerston North, Nouvelle-Zélande (<i>Commissions IV, V et VI</i>). |
| Avril | 1981: | Conférence internationale sur les Sols arides, avec une session spéciale sur la désertification – Jérusalem, Israël (<i>Commissions V et VI et Groupe de travail DS</i>). |
| May | 1981: | 3ème Symposium international sur la Télédétection et la cartographie des sols – Varsovie, Pologne (<i>Groupe de travail RS</i>). |
| Juillet | 1981: | Colloque international 'Humus et azote' – Reims, France (<i>adhésion Commission II</i>). |
| Août | 1981: | Réunion internationale de travail sur la Micromorphologie du sol – Londres, Angleterre (<i>Sous-commission B</i>). |
| Septembre | 1981: | Symposium international sur les Problèmes pédologiques en banlieues urbaines – Berlin, RFA (<i>adhésion Commission III</i>). |
| Septembre | 1981: | Colloque international sur l'Écologie de lombric – Merlewood, Angleterre (<i>adhésion Commission III</i>). |
| Septembre | 1981: | Colloque international sur le Traitement informatique des données de sol – Paris, France (<i>Groupe de travail DP</i>). |

Les comptes rendus sur toutes ces activités ont été publiés dans le Bulletin de l'AISS. Pour la plupart des réunions les Travaux ont été publiés par les Comités organisateurs concernés. Malheureusement il existe une tendance de limiter ces travaux aux comptes rendus des Symposia plénières et des Séances de discussion tandis que les contributions présentées aux sessions et sur affiches ne sont données qu'en résumé ou pas du tout. Aussi, dans plusieurs domaines il n'y a pas de référence propre du rôle de l'AISS. Dans deux cas précédents la publication des Travaux n'a pas eu lieu avant quatre ans ou plus après l'événement. De telles choses ne sont pas seulement très désagréables pour les participants eux-mêmes, mais elles contribuent aussi à créer un désintérêt général pour soumettre des documents scientifiques de valeur significative aux futures réunions de l'AISS. Il serait certainement utile que l'Association entreprenne la publication uniforme des comptes rendus complets des réunions des Commissions et des Groupes de travail (v. suggestion dans le rapport du Secrétaire général 1974, Bulletin no. 54), mais le manque du personnel et des fonds à l'AISS ne permet pas de telle entreprise. Pour le moment, le Comité exécutif ne peut que donner son appui en essayant de trouver l'éditeur et la maison d'édition appropriés. Il se peut que le Conseil de l'AISS veuille insister à ce que des organisateurs des réunions inter-Congrès garantissent la publication complète en temps opportun.

Plusieurs Groupes de travail ont tenus des petites séances de travail, notamment les Groupes sur la Fertilité des sols (FT), sur la Nomenclature des sols hydromorphes (HS), sur la Paléopédologie (PP), sur les Sols forestiers et sur les Surfaces des colloïdes de sol. Quelques autres groupes étaient apparemment dormants, ou ne se sont pas donnés de la peine d'informer le Comité exécutif de leurs activités.

Trois réunions approuvées des Commissions furent soit supprimées, soit reportées, à savoir: la Réunion sur la transformation biologique de matières organiques (Tchécoslovaquie, Commission III), le Symposium sur les problèmes des sols associés avec irrigation dans les régions de steppe aride et de savane (Ghana ou URSS – Commission VI) et le Symposium sur les sols des régions tropicales humides en Afrique et leur aménagement (Ghana – Commissions IV, V et VI). Cependant, on a pu noter les événements régionaux remarquables en science du sol les suivants:

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| Juin | 1979: | Réunion internationale sur les priorités pour alléger des contraintes relatives au sol à la production alimentaire dans les régions tropicales – Los Baños, Philippines (IRRI et Université de Cornell). |
| Juillet | 1980: | 7ème Congrès latino-américain de la science du sol – San José, Costa Rica (Sociedad Latino-americana de Ciencia del Suelo). |
| Octobre | 1980: | Symposium international sur les sols de rizières – Nanjing, Chine (Société de la Science du sol de Chine). |
| Novembre | 1980: | 1er Congrès inter-africain de la science du sol – Accra/Kumasi, Ghana (OUA Comm. de recherche scientifique et technique). |

Coopération internationale

Une étroite coopération a été maintenue avec un nombre des institutions spécialisées des Nations Unies, notamment la FAO, l'Unesco et le PNUE. Ceci aboutissait à un fort engagement de l'AISS dans deux grands thèmes entamés en particulier par le PNUE. Il s'agit ici de l'élaboration d'une politique mondiale en matière de sols (réunions de mars 1980 et février 1981, l'une et l'autre à la FAO, Rome), et la préparation d'une Base internationale de référence pour la classification des sols (IRB) (réunions de mai 1980 et juin 1981, toutes deux à Sofia). Quelques autres sujets comprenait l'agro-climatologie; l'évaluation des terres; la dégradation des sols et la désertification, et la cartographie des sols du monde. Le dernier texte explicatif de la Carte mondiale des sols FAO/Unesco a paru en 1981. Les documents issus de ce projet doi-

vent être tenus à jour pour continuer à servir son but. Toutes les nouvelles données pertinentes sont en voie d'être recueillies et assemblées (v. Bulletin no. 55). Des discussions avec l'Unesco sont en cours pour une nouvelle édition des feuilles qui ont paru les premières (1970, feuilles d'Amérique du Sud).

L'AISS a coopéré avec l'Union internationale des instituts de recherche forestière (IUFRO) à l'organisation des Colloques internationaux sur l'Evaluation des terres à des fins forestières et sur la Stabilité des écosystèmes de forêts de sapins (Groupes de travail LE et FS respectivement). Des relations de travail ont été maintenues ou établies avec l'Organisation météorologique mondiale (OMM); l'Agence internationale de l'énergie atomique (AIEA); le Centre des Nations Unies pour la science et la technologie pour le développement (UNCSTD); le Conseil international des unions scientifiques (CIUS) et son Comité scientifique des problèmes de l'environnement (SCOPE), son Comité de la recherche sur l'eau (COWAR) et son Comité sur la science et technologie dans les pays en voie de développement (COSTED); la Commission internationale des irrigations et du drainage (ICID); le Conseil international pour la recherche en agro-sylviculture (ICRAF); l'Organisation internationale pour la recherche du labour du sol (ISTRO); l'Union géographique internationale (IGU); la Société internationale de la tourbe (IPS); l'Union internationale pour l'étude du Quaternaire (INQUA); l'Association internationale pour l'étude des argiles (AIPEA); l' 'International Institute for Applied Systems Analysis' (IIASA); la Fédération internationale des instituts pour étude avancée (IFIAS); le Centre arabe pour l'étude des zones arides et terres sèches (ACSAD); l'Institut inter-américain de la science agricole (IICA), et les Programmes de la CEE sur l'Utilisation de terre et les ressources rurales et sur la Recherche agronomique orientée au développement. Aussi des contacts ont été établis avec quelques-uns des Centres internationaux de recherches agronomiques du groupe CGIAR, notamment avec son Service international pour les recherches agronomiques nationales (ISNAR). Il en va de même de plusieurs autres entités nationales qui travaillent à l'échelon international comme le Projet de sols de repère (BSP) et les différents Comités internationaux créés par le Service de conservation des sols des Etats-Unis en vue d'améliorer son système de classification des sols 'Soil Taxonomy'.

Situation financière

Le Trésorier a préparé l'état des recettes et des dépenses pour les années 1978, 1979 et 1980 (v. Bulletins nos. 55, 57 et 59). Il présentera le bilan sur 1981 et le bilan accumulé sur quatre années au Conseil de l'AISS à New Delhi.

Les cotisations actuelles ne couvrent même pas les frais d'imprimerie et d'envoi des Bulletins et des Listes de membres. Ce n'est que grâce à l'appui volontaire aux bureaux du Secrétaire général, du Secrétaire général adjoint et du Trésorier, ainsi qu'aux subventions reçues des institutions gouvernementales néerlandaises, que le fonctionnement journalier peut être maintenu à son niveau actuel. Il n'y a pas de fonds disponibles pour supporter les activités des Commissions et des Groupes de travail de l'Association, ou pour stimuler la participation des membres provenant des pays en voie de développement.

Le Bulletin

Il y a eu sept parutions, chacune de 72 ou 80 pages, pendant la dernière période de trois ans et demi. Le nombre moyen des exemplaires était de 7000. A mi-chemin de cette période on a du supprimer les facilités pour des annonces commerciales. Autrement, il n'aurait plus été possible de profiter des tarifs postaux réduits pour l'expédition à partir de Gand. L'espace de temps total entre la préparation du manuscrit à Wageningen et l'arrivée du Bulletin chez les membres est maintenant de cinq à six mois. On est en train de rechercher comment on peut le raccourcir.

En dépit de la situation financière précaire beaucoup d'efforts ont été fournis pour maintenir la qualité du Bulletin semestriel au niveau de la période antérieure. Une attention spéciale a été donnée aux sections 'Nouvelles publications' et 'Cours internationaux de formation', vue son utilité pour des pédologues aux pays, où pareille information n'est pas facilement accessible. Aussi la section sur 'Relations internationales' a été étendue en vue des besoins d'information concise sur le déploiement presque accablant des programmes internationaux qui s'occupent des sols d'une façon ou d'autre. Il y a une demande croissante d'employer la langue espagnole comme langue de travail dans le Bulletin.

Statuts et règlement

Le Comité du règlement s'était réuni formellement à Gand, Belgique, le 29 juin 1979. A cette occasion les détails du nouveau règlement approuvé ont été établis. Après l'impression ils ont été expédiés conjointement avec la Liste de membres 1979/1980 à tous les membres.

A la réunion à Gand, pendant une réunion informelle ultérieure à Rome, le 5 mars 1980 et par correspondance, un ensemble des règles supplémentaires était rédigé pour soumission au Conseil de l'AISS. Ces propositions ont été envoyées à toutes les Associations nationales en février 1981 et également publiées dans le Bulletin no. 59.

Donnant suite à la demande du Conseil à Edmonton le Secrétaire général a fini par choisir un emblème après quelques consultations informelles. L'emblème sera joint aux en-têtes des papiers à lettres de l'Association et sera appliqué d'une manière générale après le Congrès de New Delhi.

Représentation

Les membres du bureau de l'AISS ont pris part au plupart des activités inter-Congrès des Commissions et Groupes de travail, et ont représenté l'Association à un nombre d'autres réunions internationales (Conférence générale CIUS, Conférence FAO, Conférence Unesco-MAB, Réunions PNUE sur la Politique mondiale en matière des sols). A l'occasion des activités régionales ou nationales sur les sols ou durant des missions relatives à leur propre institutions scientifiques, le Secrétaire général, le Secrétaire général adjoint et/ou Trésorier ont visité les pays suivants: Angleterre, Belgique, Bulgarie, Chine, Colombie, Costa Rica, Etats-Unis d'Amérique, France, Hongrie, Inde, Indonésie, Kenya, Liban, Malaisie, Nouvelle-Zélande, Philippines, Syrie, Tchécoslovaquie. A ces occasions on a établi des contacts personnels avec les Associations nationales, on a stimulé les pédologues locaux à adhérer à l'AISS, et on a recouvré des cotisations en monnaie locale. C'était très rarement que ces représentations ont dû être débitées aux fonds maigres de l'AISS.

Général

Un sujet dont le Conseil exécutif gardait continuellement la mémoire, était la création d'une sorte d'institution internationale officielle pour l'avancement de la science du sol et ses applications agronomiques, particulièrement pour les pays en voie de développement. Référence soit faite à la résolution 2 du Congrès d'Edmonton appuyée unanimement, sollicitant la fondation d'un Institut international de recherche en science du sol (ISSRI) dans le cadre du CGIAR. Malgré le soutien actif par l'ancien président Dr. C. F. Bentley, cette idée n'a pas reçu de jugement favorable du Groupe.

Une deuxième proposition, moins ambitieuse, faisant appel à un Conseil international d'aménagement des ressources en sol, a été formulée lors d'une réunion internationale des pédologues invités aux Philippines en juin 1979, réunion organisée par l'IRRI et l'Université de Cornell. Un Comité provisoire d'organisation composé des participants a formulé des objectifs détaillés et a sollicité un appui initial de financement, jusqu'ici sans résultats tangibles.

En attendant, le Muséum international des sols (ISM), un Centre de recherche et d'information sur les sols du monde, a finalement ouvert les portes de ses locaux permanents à Wageningen, Pays-Bas (v. Bulletin no. 55). Cette institution est essentiellement une entreprise conjointe de l'AISS et l'Unesco, accueillie par le Gouvernement néerlandais. En vue d'insuffisance de réponse au plan financier pour les initiatives mentionnées ci-dessus, il est possible que l'ISM soit accueilli pour servir de point de départ du Centre international tant souhaité en science du sol, orienté au développement, et ceci après un élargissement de ces objectifs et un changement de nom. En liaison étroite avec l'AISS et les institutions comme la FAO et l'ISNAR, le Centre pourrait, avec un peu plus de personnel: établir un annuaire des personnes et institutions actives dans le domaine de la pédologie et de ses applications; assembler et diffuser des renseignements sur les projets de recherche relative au sol les plus importants, et entreprendre la traduction de littérature pertinente (voir le rapport du Secrétaire général 1974-1978).

L'étendue de la science du sol et de ses applications accroît toujours, comme ont démontré la largeur et la profondeur des sujets discutés durant la période inter-Congrès, et la diversité des choses enregistrées dans le Bulletin. Dans ces dernières années la branche de la cartographie et la classification des sols (Commission V) a reçu beaucoup d'attention. Toutefois, l'Association et son Bulletin devrait s'efforcer à donner une attention propre à *toutes* les branches, même si quelques-unes ont leur propre bulletin (comme la 'Pédofauna' de la Commission III). Ils devraient être ouverts à accommoder de nouveaux développements, comme l'attention fortement croissante pour la conservation du sol et la pollution du pédoenvironnement. Les conférences inter-Congrès, avec leurs nombres maniables de participants deviendront probablement de plus en plus importantes. Elles semblent être de bonnes occasions pour discuter d'une façon profonde et interdisciplinaire (c'est à dire entre Commissions) sur les groupes naturels pédologiques les plus importants (sols salins; sols arides; sols d'échange variable; sols hydromorphes; etc.). En plus, il y a un appel croissant pour séminaires sur de nouvelles méthodes et techniques dans l'étude des sciences du sol (évaluation des terres; télédétection, systèmes informatiques; etc.). Il est possible que de nouveaux concepts des fonctions des Souscommissions et Groupes de travail soient nécessaires à cause de ces développements.

Comme l'a signalé le Secrétaire général dans son rapport de 1978 (Bulletin no. 54), la force de notre Association réside dans son caractère professionnel et son adhésion individuelle. Le Bureau espère que tous les membres et en particulier les membres du bureau nouvellement élus des Commissions et des Groupes de travail donneront un appui efficace à l'avancement de tous les aspects de la science du sol.

L'affiliation actuelle est encore assez fortement concentrée en Europe de l'Ouest et Amérique du Nord. Un effort doit être fait pour augmenter le nombre d'adhésions d'autres régions géographiques, notamment d'Amérique latine, d'Afrique et d'Asie. En général on espère que le Congrès de New Delhi stimulera les spécialistes de la science du sol de ces régions à participer activement aux affaires de l'Association. C'est seulement dans une telle situation que l'Association internationale de la science du sol peut jouer son propre rôle dans l'avancement de la science au monde entier, et en assurant que les ressources en sols et en terres du monde soient utilisées d'une façon optimale.

Le Secrétaire général souhaite à témoigner de son appréciation pour la coopération agréable et fructueuse durant la dernière période avec le Secrétaire général adjoint Prof. Dr. I. Szabolcs et avec le Trésorier Dr. D. Gabriels. Il tient également à remercier le Conseil et le personnel de l'ISM à Wageningen pour leur support efficace.

W. G. Sombroek

BERICHT DES GENERALEKRETÄRS 1978–1981

In Übereinstimmung mit der neuen Satzung der Gesellschaft wird der Bericht des Generalsekretärs über die Zeit vom letzten Kongress (Edmonton, Kanada) an, in diesen Mitteilungen, dem letzten Heft vor dem nächsten Kongress (Neu Delhi, Indien), abgedruckt.

Mitgliedschaft

Die Zahl der Mitglieder stieg von 5416 im Juni 1978, unmittelbar vor dem Edmonton-Kongress, auf 6115 im Oktober 1981; die Mitglieder stammen nun aus 127 Ländern. In der Zwischenzeit war die Mitgliederzahl vorübergehend auf 7050 angestiegen (siehe Mitgliederverzeichnis 1979/1980). Auf Verlangen des Schatzmeisters, bei dem sich die Aufzeichnungen über den Mitgliederstand befinden, wurden später wegen Nichtbezahlens der Mitgliedsbeiträge eine Reihe von Namen aus der Liste gestrichen. Dabei waren teilweise Schwierigkeiten des Währungsaustausches schuld, in vielen anderen Fällen aber auch reine Nachlässigkeit. Da die Aussendung eigener Zahlungserinnerungen zu teuer ist, wird der Schatzmeister von nun an den entsprechenden Heften der Mitteilungen Flugblätter zur 'letzten Warnung' beilegen. Dies betrifft prinzipiell alle Mitglieder, die mehr als ein Jahr im Rückstand sind, doch wird bei Ländern mit besonderen Schwierigkeiten beim Währungsaustausch oder Ländern, in denen noch keine nationalen Gesellschaften bestehen, nachsichtiger vorgegangen werden. Das gleichzeitige Bezahlen von Beiträgen über mehrere Jahre und durch nationale Gesellschaften wird gefördert werden, um übermäßige Bankgebühren zu vermeiden.

Immer mehr nationale Gesellschaften arbeiten auf eine automatische Kopplung zwischen ihrer eigenen und der IBG-Mitgliedschaft hin (Dänemarken, Nigieren, Norwegen, Spanien u.a.), was sehr begrüsst wird. Die Zahl der nationalen Gesellschaften ist von 51 im Jahre 1978 auf 54 im Jahre 1981 angestiegen, wobei die Rückkehr der Chinesischen Bodenkundlichen Gesellschaft von besonderer Bedeutung ist. Das Sekretariat unterstützt die Bildung nationaler und regionaler bodenkundlicher Gesellschaften in mehreren afrikanischen, lateinamerikanischen und asiatischen Ländern, weil dadurch in diesen Ländern die Fortschritte in der Bodenkunde und ihre Anwendungen auf die agro-ökonomische Entwicklung gefördert werden.

Während der letzten dreieinhalb Jahre sind mehrere Mitglieder verstorben und für einige von ihnen sind in der 'In Memoriam' Rubrik der Mitteilungen Nachrufe erschienen. Mehrere von ihnen haben viele Jahre hindurch wertvolle Beiträge zu der Arbeiten der Gesellschaft geliefert und dafür die Ehrenmitgliedschaft erhalten: Dr. C. E. Kellogg (USA); Prof. Dr. M. M. Kononova (UdSSR) Prof. Dr. S. Mattson (Schweden); Prof. Dr. F. Scheffer (BRD); Prof. Dr. A. A. Rode (UdSSR) und Mr. L. Vettori (Brasilien). Besondere Erwähnung verdient auch das Hinscheiden von Prof. Dr. L. D. Baver (USA); Dr. C. R. van der Merwe (Südafrika); Prof. Dr. V. Ponomareva (UdSSR); Dr. G. D. Smith (USA) und Prof. Dr. L. Wiklander (Schweden), die alle während der letzter Jahrzehnter bedeutende Beiträge zur Wissenschaft der Bodenkunde geleistet haben.

Tätigkeiten der Kommissionen und Arbeitsgruppen

Zwischen den Kongressen fand eine Reihe offizieller Veranstaltungen statt wobei es sich handelte um:

- | | | |
|--------|-------|---|
| August | 1979: | 7. Internationales Kolloquium über Bodenzoologie – New York, USA (<i>Kommission III</i>). |
| August | 1979: | 7. Internationales Symposium 'Humus et Planta' – Brno, Tschechoslowakei (<i>Kommission II</i>). |

- November 1979: Internationales Symposium über die Stabilität von Fichtenwald-Ökosystemen (Arbeitsgruppe FS, in Zusammenarbeit mit IUFRO und Unesco-MAB).
- Februar 1980: Internationales Symposium über Grundlagen und Ausführung der Urbarmachung von Salzböden – Karnal, Indien (*Subkommission A*).
- Juni 1980: Internationales Symposium über Bodenerkundungssysteme, Fernerkundung und Bodenkartographie – Purdue, USA (*Arbeitsgruppen DP und RS*).
- Juli 1980: Internationale Konferenz über Bodenerhaltung – Silsoe, England (*Kommission I and III gemeinschaftlich*).
- August 1980: Internationales Symposium über Prinzipien der Bodenphysik im Feldmasstab – Budapest, Ungarn (*Beistimmung Kommission I*).
- September 1980: 4. Europäische Ton Konferenz – München, BRD (*Beistimmung Kommission VI*).
- November 1980: Internationale Tagung über Landbewertung für Forstwirtschaft – Wageningen, Niederlande (*Arbeitsgruppe LE*, mit IUFRO).
- Januar 1981: 2. Internationales Symposium über Saure Sulfatböden – Bangkok, Thailand (*beantragte Arbeitsgruppe AS*).
- Februar 1981: Internationale Konferenz über Böden mit variabler Ladung – Palmerston, Neuseeland (*Kommissionen IV, V und VI*).
- April 1981: Internationale Konferenz über Wüstenböden, mit einer speziellen Abteilung über Verwüstung – Jerusalem, Israel (*Kommissionen V und VI, und Arbeitsgruppe DS*).
- Mai 1981: 3. Internationales Symposium über Fernerkundung für Bodenkartographie – Warschau, Polen (*Arbeitsgruppe RS*).
- Juli 1981: Internationales Kolloquium über Humus und Stickstoff – Reims, Frankreich (*Beistimmung Kommission II*).
- August 1981: Internationale Arbeitstagung über Bodenmikromorphologie – London, England (*Subkommission B*).
- September 1981: Internationales Symposium über Bodenprobleme in städtischen Gebieten – Berlin, BRD (*Beistimmung Kommission III*).
- September 1981: Internationales Kolloquium über Regenwurmökologie – Merlewood, England (*Beistimmung Kommission III*).
- September 1981: Internationales Kolloquium über die Verarbeitung von Bödenangaben – Paris, Frankreich (*Arbeitsgruppe DP*).

Zusammenfassende Berichte aller dieser Veranstaltungen sind in den Mitteilungen der IBG erschienen. Bei den meisten Tagungen wurden durch das jeweilige Organisationskomitee auch Berichte veröffentlicht. Leider werden diese Berichte häufig auf die Plenarvorträge und allgemeinen Veranstaltungen beschränkt, während die Vorträge und Posters bestenfalls noch als Kurzfassungen erscheinen. Manchmal wird auch nicht entsprechend auf die Beteiligung der IBG verwiesen. In zwei früheren Fällen sind die Berichte erst vier oder mehr Jahre nach der Veranstaltung erschienen. Solche Vorkommnisse sind nicht nur für die Teilnehmer selbst höchst unerfreulich, sondern verursachen auch eine allgemeine Abneigung, wissenschaftliche Arbeiten von einigem Standard an zukünftige IBG-Konferenzen einzusenden. Eine einheitliche Veröffentlichung der gesamten Berichte der Konferenzen von Kommissionen und Arbeitsgruppen durch die Gesellschaft (siehe den Vorschlag des Generalsekretärs im Bericht 1974–1978 Mitteilungen Nr. 54) wäre sicher von Vorteil, doch erlauben die beschränkten finanziellen und personellen Mittel der IBG ein solches Vorgehen nicht. Zur Zeit kann der Verwaltungsausschuss nur dabei helfen, geeignete Herausgeber und Verleger zu finden. Der IBG-Beirat würde gerne darauf bestehen, dass

sich Veranstalter von Tagungen zwischen den Kongressen dazu verpflichtet, die gesamten Berichte zu veröffentlichen, und zwar rechtzeitig.

Einige Arbeitsgruppen hielten kleine oder informelle Tagungen ab, und zwar die Arbeitsgruppen für Bodenfruchtbarkeitsuntersuchung (FT), für die Nomenklatur hydromorfer Böden (HS), für Palaeopedologie (PD), für Waldböden (FS) und für die Bodenkolloidale Oberfläche (CO). Andere Arbeitsgruppen waren offensichtlich nicht tätig oder haben es verabsäumt, die IBG-Verwaltung über ihre Tätigkeiten zu informieren.

Drei anerkannte Kommissionssitzungen wurden entweder abgesagt oder verschoben, nämlich die Tagung über Biologische Veränderungen der Organischen Substanz (Tschechoslowakei – Kommission III), das Symposium über Bodenprobleme im Zusammenhang mit der Bewässerung von ariden Steppen- und Savannengebieten (Ghana oder UdSSR – Kommission VI) und das Symposium über die Böden der humiden Tropen von Afrika und ihre Bewirtschaftung (Ghana – Kommissionen IV, V und VI).

Bemerkenswerte regionale bodenkundliche Ereignisse waren:

- | | | |
|----------|-------|--|
| Juni | 1979: | Internationale Treffen über Prioritäten bei der Milderung bodenbedingter Beschränkungen der Nahrungsmittelproduktion in den Tropen – Los Baños, Phillipinen (IRRI und Cornell University). |
| Juli | 1980: | 7. Lateinamerikanischer Kongress für Bodenkunde – San José, Costa Rica (Sociedad Latino-americano de Ciencia del Suelo). |
| Oktober | 1980: | Internationales Symposium über überflutete Reisböden – Nanjing, China (Chinesische Gesellschaft für Bodenkunde). |
| November | 1980: | 1. Inter-afrikanischer Kongress für Bodenkunde – Accra/Kumasi, Ghana (OAU Scientific, Technical & Research Commission). |

Internationale Zusammenarbeit

Die enge Zusammenarbeit mit einigen Sonderabteilungen der Vereinten Nationen wurde aufrechterhalten, nämlich mit der FAO, der Unesco und dem UNEP. Dies führte zu einer starken Beteiligung der IBG an 2 wichtigen Gebieten, besonders auf der Initiative des UNEP. Es handelt sich um die Ausarbeitung einer Welt-Bodenstrategie (Tagungen März 1980 und Februar 1981, beide bei der FAO in Rom) und um die Anfertigung einer Internationalen Vergleichsnorm zur Bodenklassifikation (Tagungen im Mai 1980 und Juni 1981, beide in Sofia). Andere Themen waren Agro-Klimatologie; Bodenbewertung, Bodenzerstörung und -verwüstung, sowie Welt-Boden-Kartierung. Der jüngste erklärende Text zur FAO/Unesco Weltbodenkarte erschien im Jahre 1981. Die in diesem Projekt erarbeiteten Unterlagen müssen, um ihren Zweck zu erfüllen, ständig auf den neuesten Stand gebracht werden. Daher werden alle relevanten neuen Informationen gesammelt und zusammengestellt (Mitteilungen Nr. 55). Zurzeit wird mit der Unesco im Hinblick auf eine neue Ausgabe der Einzelkarten, die erstmalig 1970 veröffentlicht worden sind, verhandelt (1970 Südamerika-Karten).

Die IBG hat mit der Internationalen Union der Forstwirtschaftlichen Untersuchungsstellen (IUFRO) durch die Veranstaltung internationaler Tagungen über Landbewertung in der Forstwirtschaft (Arbeitsgruppe LE) und über die Stabilität von Fichtenwald-Ökosystemen (Arbeitsgruppe FS) zusammengearbeitet. Ausserdem wurden mit den folgenden Institutionen die Zusammenarbeit aufgenommen oder fortgesetzt: der Meteorologischen Weltorganisation (WMO), der Internationalen Atomenergiebehörde (IAEA), dem Zentrum für die Wissenschaft und Technologie der Entwicklung (UNCSTD) der Vereinten Nationen, dem internationalen Rat für Land- und Forstwirtschaftliche Untersuchungen (ICRAF); der Internationalen Or-

ganisation für Bodenbearbeitungsforschung (ISTRO), der Internationalen Geographischen Union (IGU), der Internationalen Torfgesellschaft (IPS), der Internationalen Union für Quartär Untersuchungen (INQUA); der Internationalen Vereinigung zum Studium der Tone (AIPEA); dem Internationalen Institut für Angewandte Systemanalyse (IIASA); dem Internationalen Verband der Institute für Höhere Studien (IFIAS); dem Arabischen Zentrum zur Untersuchung der ariden Zonen und Trockengebiete (ACSAD); dem Inter-amerikanischen Institut für Landwirtschaftliche Forschung (IICA) und den beiden EWG-Programmen über Landnutzung und ländliche Ressourcen sowie über Entwicklungsorientierte Landwirtschaftliche Forschung. Zu einigen der Internationalen Landwirtschaftlichen Untersuchungszentren der CGIAR-Gruppe wurden Kontakte aufgenommen, besonders zu deren Internationalem Hilfsdienst für Nationale Landwirtschaftliche Forschung (ISNAR). Dasselbe trifft auf einige nationale Körperschaften mit internationalem Wirkungsbereich zu, wie dem Benchmark Bodenprojekt (BSP) und den verschiedenen internationalen Komitees, die vom USDA-Bodenerhaltungsdienst zur Verbesserung des US-Bodenklassifikationssystems ins Leben gerufen worden sind.

Finanzielle Situation

Der Schatzmeister hat für die Jahre 1978, 1979 und 1980 Einnahmen-Ausgaben-Rechnungen erstellt (siehe Mitteilungen Nr. 55, 57 und 59). Die Bilanz 1981 sowie die Gesamtbilanz über die vier Jahre wird er dem Beirat in Neu Delhi vorlegen.

Die derzeitigen Mitgliedsbeiträge decken nicht einmal die Kosten für Druck und Versand der Mitteilungen und Mitgliederverzeichnisse. Nur durch freiwillige Spenden in den Büros des Generalsekretärs, des stellvertretenden Generalsekretärs und des Schatzmeisters, und durch Zuschüsse verschiedener holländischer Regierungsinstitutionen können die laufenden Arbeiten auf ihrem derzeitigen Stand aufrecht erhalten bleiben. Zur Unterstützung der Tätigkeiten der Kommissionen und Arbeitsgruppen der Gesellschaft oder zur Förderung der Teilnahme von Mitgliedern aus Entwicklungsländern steht kein Geld zur Verfügung.

Das Mitteilungsblatt

Sieben Hefte, jedes zwischen 72 und 80 Seiten stark, sind im Laufe der vergangenen $3\frac{1}{2}$ Jahre erschienen, bei einer durchschnittlichen Auflage von 7000 Stück. Die Möglichkeit zum Abdruck kommerzieller Anzeigen wurde mitten in diesem Zeitraum entnommen; sonst könnte von dem relativ kostengünstigen Versand, der jetzt durch ermässigte Portogebühren von Gent aus möglich ist, kein Gebrauch mehr gemacht werden. Die gesamte Zeitspanne zwischen dem Schreiben des Textes in Wageningen und dem Eintreffen der Mitteilungen bei den Mitgliedern beträgt zur Zeit fünf bis sechs Monate. Möglichkeiten, um diese Zeit zu verkürzen, werden erwogen.

Trotz der angespannten Finanzlage wurde viel Mühe darauf verwendet, die Qualität der beiden jährlichen Hefte auf ihre früheren Standard zu halten. Besondere Aufmerksamkeit wurde den Sparten 'Neue Veröffentlichungen' und 'Internationale Fortbildungskurse' geschenkt, und zwar in Anbetracht ihrer Wichtigkeit für Bodenkundler in Ländern, wo derartige Informationen schwer zu beschaffen sind. Ausserdem, wurde die Rubrik über 'Internationale Verbindungen' ausgeweitet, im Hinblick auf die Notwendigkeit bündiger Information über die schier unübersehbare Fülle internationaler Programme, die sich auf die eine oder ander Weise mit Böden beschäftigen.

Immer stärker wird die Forderung, auch Spanisch als Geschäftssprache in die Mitteilungen aufzunehmen.

Satzung und Statuten

Das Satzungskomitee hat sich am 29. Juni 1979 formell in Gent getroffen, wobei

Einzelheiten der neu gefassten Satzung festgelegt wurden. Diese wurden anschliessend gedruckt und zusammen mit der Mitgliederliste 1979/80 an alle Mitglieder versandt.

Bei dem Treffen in Gent, während eines späteren informellen Treffens in Rom am 5. März 1980 und durch Briefwechsel wurden Statuten zur Vorlage an den IBG-Berater verfasst. Dieser Entwurf wurde im Februar 1981 an alle Nationalen Gesellschaften verschickt und ausserdem in den Mitteilungen Nr. 59 abgedruckt.

Der Generalsekretär hat sich auf Ersuchen des Edmonton-Ausschusses nach mehreren informellen Konsultationen endgültig für ein Emblem entschieden. Das Emblem wird den einheitlichen Briefköpfen der Gesellschaft eingefügt und soll nach dem Neu Delhi-Kongress allgemein verwendet werden.

Repräsentationen

Vorstandsmitglieder der IBG nahmen an den meisten Veranstaltungen der Kommissionen und Arbeitsgruppen in der Zwischenkongresszeit teil und vertraten die Gesellschaft bei zahlreichen Internationalen Konferenzen (ICSU General-konferenz, FAO-Konferenz, Unesco-MAB Konferenz, UNEP Welt-Bodenstrategie Tagungen).

Anlässlich regionaler oder nationaler Veranstaltungen über Böden oder während Dienstreisen im Zusammenhang mit ihren eigenen wissenschaftlichen Institutionen haben der Generalsekretär sowie sein Stellvertreter und/oder der Schatzmeister Belgien, Bulgarien, China, Kolumbien, Costa Rica, die Tschechoslowakei, England, Frankreich, Ungarn, Indien, Indonesien, Kenya, den Libanon, Malaysia, Neuseeland, die Philippinen, Syrien, Thailand und die VSA besucht. Bei solchen Gelegenheiten wurden Kontakte zu Nationalen Gesellschaften gelegt, die örtlichen Bodenkundler angeregt, der IBG beizutreten, und Mitgliedsbeiträge in der jeweiligen Währung eingesammelt. Nur ganz selten mussten diese Repräsentationen auf Rechnung der spärlichen IBG-Mittel gehen.

Allgemeines

Ein Thema, das die Verwaltung ständig beschäftigte, war die Errichtung irgendeiner formellen internationalen Institution für den Fortschritt der Bodenkunde und ihrer landwirtschaftlichen Anwendung, besonders für Entwicklungsländer. Ausgangspunkt war die einstimmig beschlossene Entschliessung 2 des Edmonton-Kongresses, in der die Gründung eines Internationalen Bodenkundlichen Forschungsinstitutes innerhalb der CGIAR-Organisation gefordert wurde. Trotz der aktiven Unterstützung der ehemaligen Präsidenten Dr. C. F. Bentley wurde dieser Vorschlag durch die beratende Gruppe nicht positiv aufgenommen.

Ein anderer, weniger ehrgeiziger Vorschlag betraf die Errichtung einer internationalen Behörde zur Bewirtschaftung der Bodenressourcen (IBSRM) und wurde bei einem internationalen Treffen von eingeladenen Bodenkundlern auf den Philippinen im June 1979 gemacht, welches vom IRRI und der Cornell University veranstaltet worden war. Ein provisorisches Leitungsgremium aus den Teilnehmern formulierte detaillierte Zielsetzungen und bemühte sich um anfängliche finanzielle Unterstützung, bisher allerdings ohne greifbare Ergebnisse.

In der Zwischenzeit eröffnete das Internationale Bodendomuseum (ISM), ein Zentrum für Forschung und Information über alle Böden der Welt, endgültig seine Räume in Wageningen, Niederlande (siehe Mitteilungen Nr. 55). Diese Institution ist im Wesentlichen eine Gemeinschaftsunternehmung der IBG und der Unesco, untergebracht durch die holländische Regierung. Angesichts der mangelnden Unterstützung der oben erwähnten Initiativen, könnte das ISM nach Erweiterung seines Aufgabenbereiches und einer Namensänderung tatsächlich ein willkommener Ausgangspunkt für das dringend erforderliche entwicklungsorientierte Zentrum für Bodenkunde sein. In

enger Zusammenarbeit mit der IBG und Institutionen wie FAO und ISNAR, könnte das Zentrum mit einigen zusätzlichen Angestellten ein Direktorium von Personen und Instanzen erstellen, die auf dem Gebiete der Bodenkunde und ihrer Anwendung tätig sind, sowie Information wichtiger bodenbezogener Forschungsprojekte ordnen und verbreiten und relevante Literatur übersetzen (vgl. den Bericht des Generalsekretärs 1974–1978).

Der Wirkungsbereich der Bodenkunde und seiner Anwendungen wird immer grösser, wie an der Breite und Tiefe der in der Zwischenkongresszeit diskutierten Themen und der Verschiedenheit der in den Mitteilungen angeführten Sachpunkte deutlich wird. In letzter Zeit erfährt der Bereich der Bodenkartographie und –klassifikation (Kommission V) besondere Beachtung. Die Gesellschaft und ihre Mitteilungen sollten allerdings versuchen, *allen* Bereichen die nötige Aufmerksamkeit zu schenken, obwohl einzelne Bereiche sogar eine eigene Zeitschrift (wie 'Pedofauna' von Kommission III) haben. Es sollte auch allen neuen Entwicklungen offenstehen, wie dem stark zunehmenden Interesse an Bodenerhaltung und an Umweltverschmutzung von Böden. Die Konferenzen zwischen den Kongressen mit ihrer handliche Anzahl von Teilnehmern, werden wahrscheinlich weiterhin an Bedeutung zunehmen. Sie scheinen gute Gelegenheiten zu sein, tiefgehende und interdisziplinäre (also interkommissionelle) Diskussionen über grössere natürliche Bodenarten (Salzböden, aride Böden, variable Ladungsböden, hydromorphe Böden u.s.w.) zu führen. Weiter gibt es zunehmend Forderungen nach Arbeitstagungen über neue Methoden und Techniken beim Studium der Bodenkunde (Landbewertung; Fernerkundung; Informationssysteme u.s.w.). Möglicherweise sollten aufgrund dieser Entwicklungen neue Richtlinien für die Aufgaben der Subkommissionen und Arbeitsgruppen erstellt werden.

Wie vom Generalsekretär in seinem Bericht im Jahre 1978 (Mitteilungen Nr. 54) unterstrichen wurde, liegt die Stärke unserer Gesellschaft in ihrer fachlichen Eigenart und ihrer individuellen Mitgliedschaft. Die Verwaltung hofft auf wirkungsvolle Unterstützung aller Mitglieder und besonders der neu gewählten Vorstände der Kommissionen und Arbeitsgruppen bei ihrer Arbeit auf allen Teilgebieten der Bodenkunde.

Gegenwärtig sind die meisten Mitglieder noch in Westeuropa und Nordamerika beheimatet. Die Bemühungen, mehr Mitglieder aus anderen geographischen Regionen zu gewinnen, besonders aus Lateinamerika, Afrika und Asien, sollten verstärkt worden. Hoffentlich wird der Kongress in Neu Delhi das aktive Interesse der Bodenkundler aus diesen Ländern an IBG-Angelegenheiten noch weiter vergrössern. Nur dann kann die Internationale Bodenkundliche Gesellschaft die ihr angemessene Rolle beim Fortschritt der Wissenschaft in der Welt erfüllen und gleichzeitig sicherstellen, dass die Boden- und Landressourcen der Erde optimal genützt werden.

Der Generalsekretär möchte die nette und fruchtbare Zusammenarbeit mit den stellvertretenden Generalsekretär Prof. Dr. I. Szabolcs und dem Schatzmeister Dr. D. Gabriels in der abgelaufenen Periode dankbar anerkennen. Ausserdem möchte er der Leitung und den Mitarbeitern des ISM in Wageningen für ihre wirkungsvolle Unterstützung danken.

W. G. Sombroek

**ACTIVITIES OF THE COMMISSIONS AND WORKING GROUPS
ACTIVITÉS DES COMMISSIONS ET GROUPES DE TRAVAIL
TÄTIGKEIT DER KOMMISSIONEN UND ARBEITSGRUPPEN**

ISSS Commission II

Report on the
INTERNATIONAL COLLOQUIUM "HUMUS - NITROGEN"
Reims, France, July 7-10, 1981.

This Colloquium, the brain child of F. Jacquin (France), was convened by F. Jacquin (France) and P. Dutil (France). The Chairman of the Colloquium, which was cosponsored by Commission II of the International Society of Soil Science and by the French Association of Soil Science was M. Schnitzer (Canada). One hundred and twenty-five scientists from France and 15 other countries attended. A total of 45 scientific communications were presented. M. Schnitzer (Canada) gave the introductory lecture which was entitled, 'Toward a better understanding of the interrelationship between humus and nitrogen: a key scientific and economic problem in international agriculture'. He observed that while beneficial, the application of nitrogen containing fertilizers was based on heavy inputs of non-renewable energy which were often harmful to the environment. Techniques must be developed that will reduce losses through volatilization, leaching and denitrification of both native and applied nitrogen. What was urgently needed was more comprehensive knowledge and understanding of the major reactants and of the major chemical and biochemical reactions that control the soil nitrogen cycle. This will eventually lead to the development of technologies that will allow us to make more efficient use of the nitrogen already in soils.

Since more than 90% of the soil nitrogen is associated with the organic matter, the theme of the Colloquium was most pertinent. The scientific papers which were presented during the first 2 days covered the following topics: the chemical structure of humic materials and soil polysaccharides, effects of mineral fertilizers on humus formation, different nitrogen forms in soils, mineralization and immobilization of soil nitrogen, nitrification and denitrification, nitrogen fixation, nitrogen and water fluxes in soils, models for organic matter and nitrogen transformations, and, last but not least, manures.

The third day was devoted to a field trip. During the morning several profiles in the neighbourhood of Reims (a sol brun lessivé and a sol brun lessivé dégradé à fragipan) were examined. Also, an area where sugar beets were grown and a large grain farm were visited. A delicious lunch, prepared by the students of the local agricultural High School, was had at Crezancy. During the afternoon we travelled through the Marne valley, a wine growing area. We visited a champagne cave at Epernay and had a taste of that delicate drink. The trip ended with an inspection of the I.N.R.A. Experimental Station at Chalons-sur-Marne, where we were shown a profile of soils typical of the Champagne Crayeuse (on chalker) and an impressive array of lysimeters.

The morning of the 4th and last day was devoted to summaries of the scientific papers by P. Duchaufour (France) and H. Laudelout (Belgium). The final summary was presented by M. Schnitzer (Canada). The feeling of most participants was that additional basic and applied research was required in the future to come to grips with the problems discussed at the Colloquium. Also, the importance of multidisciplinary approaches was recognized. F. Jacquin and P. Dutil (France) have made a significant contribution to the advancement of soil science by convening a Colloquium on this very timely topic.

M. Schnitzer, Ottawa, Canada

ISSS Commissions III and IV

Announcement

MEETING ON BIOLOGICAL PROCESSES AND SOIL FERTILITY

University of Reading - England, 4-8 July 1983

A meeting of Commissions III and IV of the ISSS in collaboration with the British Society of Soil Science. The programme will include paper reading sessions, poster sessions and visits to U.K. institutes involved in soil research.

The main topics of the meeting will be:

- (1) Cycling of nitrogen in modern agricultural systems.
- (2) The role of soil microorganisms in mediating plant nutrient uptake from soil.
- (3) Interactions between biological processes, cultivation and soil structure.
- (4) Effects of pesticides and toxic materials on biological processes in soil.
- (5) Anaerobic processes in soil.
- (6) Biological and biochemical analyses of soils.

Language: English

Registration will cost in the region of £ 20 and will include a copy of the Proceedings.

Accommodation is expected to cost about £ 20 per day and will be in University Halls of Residence.

A programme for accompanying persons will be arranged if demand is sufficient. Attendance will be limited to 500 and a early response is advisable.

NOTICE OF INTENT

(Please type or print in block letters)

Name: Title:

First Name(s) or initials:

Institution and address:

.....

.....

Please tick

- I am interested in receiving further details of the meeting.
- I expect to attend the meeting on July 4-8, 1983.
- I am interested in a programme for accompanying persons.

I propose to submit a paper or a poster on one of the following topic areas:

1	2	3	4	5	6	Other
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

This notice of intent should be returned by 1st May 1982 to:-

Dr. P. J. Harris (Local Secretary),
Department of Soil Science, The University, London Road, Reading, RG1 5AQ,
United Kingdom.

ISSS Commission III

Announcement

INTERNATIONAL SYMPOSIUM ON N₂ FIXATION WITH NON-LEGUMES

Banff, Alberta, Canada 5-10 September, 1982

The 2nd International Symposium on N₂ Fixation with Non-Legumes will be held from 5-10 September 1982 in the scenic mountain resort of Banff, Alberta, Canada. The symposium is sponsored jointly by the Agricultural Institute of Canada and the Canadian Society of Microbiologists. The theme is 'Putting N₂ Fixation to Work' and will concentrate on N₂ fixation in association with non-legumes and trees.

Sessions will be held on:

1. Microbiology of the association (isolation, enumeration identification)
2. Genetics of the host plant and the bacteria
3. The site and process of the association
4. Techniques of measuring N₂ fixation
5. Application and exploitation of these associations.

The proceedings of the symposium will be published as a special issue of the Canadian Journal of Microbiology. For further information please contact: Dr. R. J. Renne CAN-FIX, Box 7000, Lethbridge, Alberta, Canada T1J 4A9

ISSS Commission VI

Report on the

INTERNATIONAL SYMPOSIUM ON SOIL PROBLEMS IN URBAN AREAS

Berlin, Germany, 7-9 September 1981

Soil Problems in urban areas was the subject of a symposium held in Berlin the week of September 6 under auspices of the German Soil Science Society. The symposium was held in conjunction with the Society's annual meetings. The symposium and the meetings attracted an international audience of scientists from 18 countries, many of whom also gave papers. Total attendance was 320, but colleagues from East Germany were missed.

The Conference opened with a general session in which the soils of the Berlin area were described followed by four general papers which dealt with (a) soil deterioration and contamination in urban areas, (b) problems of soil fertility, (c) soils and soil modification for sports and leisure uses, and (d) reclamation and integration of landfills into the urban landscape. Concurrent sessions during the remainder of the week consisted of volunteer papers under all Commission headings. Papers on specific details of urban soil problems as well as volunteer papers on various other subjects of general interest were given.

Participants were able to choose among a wide variety of field excursions during the week. Two of these half day excursions were directed to interesting aspects of soil-environment interactions in Urban Berlin. The population density of Berlin of around 3000 persons per square kilometer brought the soil problems of urban areas into sharp focus. One on Monday took the participants to look at soils developing in parks, on rubble fills and on a garbage landfill. A second, on Tuesday, considered roadside soil pollution and sewage irrigation. There were also various tours of cultural and historical interest during the week.

Professor H. -P. Blume of the Technical University of Berlin was host of the Conference. He arranged the tours and was responsible for all local arrangements and housing. Participants were most complimentary of the excellent arrangements and expressed gratitude to him and his colleagues for their considerable efforts.

George Blake, St. Paul, Minnesota, USA

Report on the
SIXTH INTERNATIONAL MEETING ON SOIL MICROMORPHOLOGY
London, U.K., 17-21 August, 1981.

This meeting was the first since the formation in 1978 of the ISSS Sub-Commission of Soil Micromorphology (formerly it was a Working Group of ISSS). Approximately 120 participants and 30 guests from a total of 30 countries met at University College, London, England from August 17-21, 1981. More than a third of them went on the post-meeting excursion through England and Wales, August 23-29. Delegates were welcomed at the opening session by W. McDermott, President, British Society of Soil Science; D. Mackney, Head, Soil Survey of England and Wales; and W. Sombroek, Secretary-General of ISSS. Peter Bullock, president of the Sub-Commission gave a stimulating opening address on the changing face of soil micromorphology.

The programme of the meeting differed from that of previous meetings. Only keynote review papers were presented orally and these were given in plenary sessions. The keynote papers were organized under four main topics as follows:

Techniques - optical microscope, SEM, microchemical analysis in thin sections, and image analysis.

Processes and Diagnostic Horizons - clay coatings and the argillic horizon, podzolization and the spodic horizon, laterization and the oxic horizon, turbation and the vertic horizon, weathering and the cambic horizon.

Applications - agriculture, archaeology, soil mechanics, Quaternary geology.

Organic matter - alteration of plant material

Other contributions were presented as posters most of which were displayed throughout the meeting. Time was allocated for discussion of the poster papers with the authors, and for general discussion of keynote topics and the associated posters. Forums on thin sections preparation, teaching of micromorphology and humus forms were held. A mid-week break from meetings provided a choice of day-long excursions to either Rothamsted Experimental Station or Wye College, Kent.

Programme arrangements by Peter Bullock and his committee were excellent; size, acoustics, and visibility (screen) of the meeting room met the requirements ideally; the long hallways (cloisters) with coffee at the far end provided excellent opportunity to view approximately 80 posters, to covet the new equipment displayed, and to meet colleagues; the mid-week excursions were informative and pleasant; and the guests' programme and the banquet that ended the meeting were highly enjoyable.

Organization alone, however, does not ensure a productive meeting; the participants must deliver. To a large extent they did. There were many excellent posters and many exchanges of views about the information presented. Some of the keynote papers outlined the state-of-the-art as intended; a few gave review of only the work of the author; a few were excessively long; a few were poorly prepared and presented; and some authors of scheduled keynote papers were unable to attend the meeting. Discussion of keynote papers and posters was lively. Allocating time for general discussion proved to be successful. There was not time to do justice to all of the posters; that would have required a longer meeting.

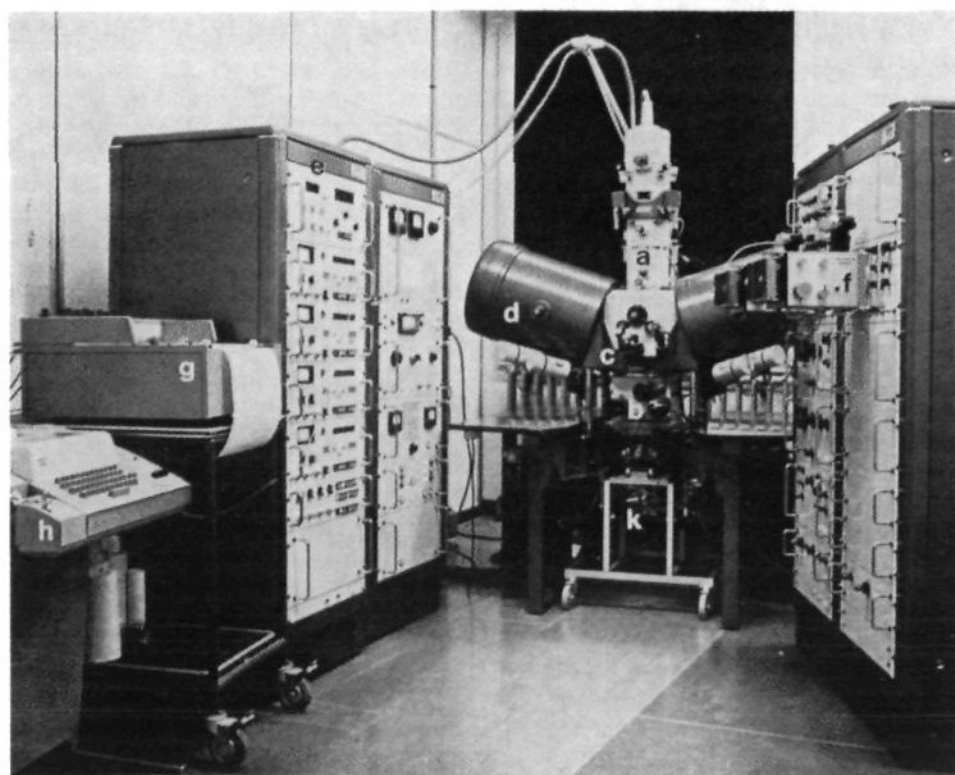
The forum on thin section preparation aroused interest and much discussion. It showed that there is a need to evaluate the results from the wide variety of techniques used for impregnating soils and preparing sections. The forum of humus forms indicated a great need to standardize terminology and definitions related to the topic. Information on teaching micromorphology was presented at the other forum.

Developments in soil micromorphological equipment: from supporting field studies to fancy office electronics.

Right: The original field microscope as introduced by the late Prof. W. L. Kubiëna in 1932 (courtesy Dr. U. Babel-Hohenheim).



Below: Electron microprobe analyser (type MS46-Cameca) as used these days by specialised micromorphological laboratories (courtesy Dr. E. Bisdorf - Wageningen).



The meeting ended with reports from advisory groups, and with the tentative selection of site of the next meeting and of candidates to be recommended as officials of the Sub-Commission. Dr. Sombroek, who chaired this part of the meeting, explained that decisions on the recommendations would be made at the ISSS meeting in India. Dr. Bullock reported excellent progress by the advisory group on 'The Descriptive System for Soil Micromorphology'. A well-illustrated book on the subject will be published early in 1982. Dr. Bisdom reported progress of the advisory group on 'Weathering and neof ormation'. Several papers have been published and further work is in progress. The advisory group on organic matter reported little activity.

Numerous suggestions were made regarding tasks for the Sub-Commission during the next four years. Many of these could be grouped under the heading of standardization. With the new 'Descriptive System' the time is ripe for preparation and distribution of reference thin sections for soil micromorphologists to describe. Comparisons of such descriptions and of quantitative estimates of certain features (argillans, papules, voids, etc.) is required followed by working meetings to resolve differences and to develop standards. The suggestion to assemble the best information on thin section preparation is another aspect of standardization.

There were four volunteers to host the next meeting. France, Malaysia and Thailand, Turkey, and the U.S.A.; France was chosen by the delegates. Officials recommended were: G. Stoops, President, R. Miedema, Secretary; P. Bullock, Past President; N. Fedoroff and J. A. McKeague, Vice Presidents.

Fifty-five delegates and guests participated in the 6-day excursion following the meeting. Under sunny skies, the tour proceeded through the beautiful countryside of England and Wales to Cambridge, Nottingham, Chester, Bangor, Shrewsbury and Oxford. A wide range of soils and landscapes were shown. The soil surveyor of the area 'explained' the soil; Peter Bullock showed the micromorphological features; Brian Avery outlined the taxonomy in the British, U.S. and FAO systems and Ben Clayden kept the discussion in order. Organization was excellent and participants had a full and a thoroughly enjoyable week that terminated with an international variety show led by Ben Clayden.

The first meeting of soil micromorphologists as a Sub-Commission of ISSS was undoubtedly a success both as a forum for scientific exchange and as event that united people from 30 countries almost as a family. Progress was evident in several aspects of soil micromorphology. Its major application is still in the field of soil genesis and classification but there is much scope and promise in other fields. New techniques that extend light microscopy to the submicroscopic realm show much promise that remains to be exploited. Proceedings of the meeting are to be published, probably early in 1982. The organizers deserve warm congratulations for the excellent arrangements and for fostering the international spirit of the meeting.

J. A. McKeague, Ottawa, Canada

Compte rendu du
COLLOQUE SUR TRAITEMENT INFORMATIQUE DES DONNÉES DE SOL
Paris, France, 14-17 septembre 1981

Le Groupe de Travail 'Pédologie et Informatique' s'est réuni à Paris pour le colloque 'Traitement informatique des données de sol', organisé par l'Institut National Agronomique (INA) Paris-Grignon avec le concours de l'Institut National de la Recherche Agronomique (INRA) et de l'Association Internationale Informatique et Biosphère (I & B). Parmi les 72 participants un nombre de 34 venait de l'étranger, surtout de l'Europe de l'Est et de l'Ouest. Aussi le Programme des Nations Unies pour l'environnement (PNUE) était représenté.

Les communications et les discussions embrassaient une gamme de sujets plus grande que dans les années passées, ce qui reflète des tendances actuelles en technologie et en sciences. Trois grands champs d'intérêt étaient perceptibles:

a) *Les systèmes informatiques des données de sol.* Il y avait encore quelques discussions sur des points de détail concernant l'enregistrement des données et la technologie d'ordinateurs, mais beaucoup de participants avaient quelque expérience avec la mise sur pied de tels systèmes et étaient en mesure de discuter leur expérience pratique. Maintenant, quatre groupes d'organisations peuvent être distingués:

I celles aux pays où la prospection a été achevée. Le système informatique est utilisé pour maximaliser l'emploi de données pédologiques dans les domaines de l'évaluation des terres et de la planification.

II celles aux pays où la prospection est partiellement achevée. Les systèmes informatiques sont nécessaires pour les objectifs de I) et également pour rattacher des nouvelles données aux anciennes et pour rendre la production plus efficace.

III celles aux pays, où il reste encore beaucoup à faire. Automatisation est considérée comme moyen d'améliorer l'efficacité et la flexibilité.

IV celles aux pays qui doivent encore démarrer.

Il est prévu, que la plupart des développements dans les années prochaines se produiront aux instituts en groupes III) en IV).

Un aspect important des systèmes informatiques est que ceux-ci permettent d'analyser les données de sol, et plusieurs communications ont présenté des vues générales statistiques des données de sol à l'échelle nationale. Evidemment ces études ont suscité beaucoup de questions sur la qualité des données qui ont été enregistrées et sur le manque d'information concernant le niveau des erreurs de mesure, aussi bien sur le terrain qu'au laboratoire, ce qui peut très bien rendre beaucoup de données peu fidèles ou, au moins, impossibles à comparer.

b) *L'analyse spatiale et la géostatistique.* L'application de l'analyse spatiale et de la géostatistique pour l'emploi efficace des données pédologiques pour la détection de l'échelle de variabilité du sol et pour l'interpolation spatiale était présentée pour la première fois dans une réunion européenne. Le long de ces études il devenait clair qu'il existe souvent une forte variabilité à courte distance dans les sols européens, ce qui touche toutes les questions de l'évaluation des terres, de la classification et de la cartographie des sols. Ceci était également démontré en passant dans d'autres communications et pendant l'excursion sur le terrain.

c) *Simulation.* L'intérêt à la simulation se situe surtout en essayant de développer des modèles principalement déterministiques – mélanges, équilibres d'argile, nitrification, mouvement d'eau.

En général, ces études étaient complètement séparées des données dans les systèmes

d'information. Nous n'avons pas encore atteint le stade d'être en mesure d'appliquer les connaissances acquises par simulation aux unités cartographiques entières.

Une visite aux banques de données de sol de l'INRA et de l'ORSTOM faisait partie du colloque. Pendant la réunion, Dr. Stein Bie annonçait sa démission comme Secrétaire du Groupe de Travail, et aussi la démission imminente du Président, Dr. ir. J. Schelling à la prochaine réunion de l'AISS à New Delhi en 1982. Dr. P. A. Burrough, Département des Sciences Pédologiques et de la Cartographie des sols, Université d'Agriculture, Wageningen, Pays-Bas fut nommé le nouveau secrétaire, pour prendre effet immédiatement, avec Dr. A. Moore du CSIRO, Brisbane, Australie, nommé le nouveau Président quand Dr. Schelling quitte sa fonction.

Ces positions seront ratifiées à la réunion de la Commission V de l'AISS à New Delhi. Le nouveau secrétaire a proposé une motion de remerciement à Dr. Bie et à Dr. Schelling pour leur travail et enthousiasme qu'ils ont déployé en mettant sur pied le Groupe de Travail et en le dirigeant pendant les six premières années (1975-1981).

Il y avait un consensus que la réunion a été très utile, mais qu'il restait encore beaucoup d'aspects qui méritaient des études plus détaillées. Celles-ci comprenaient le rôle des banques des données de sol pour les pays en voie de développement, l'application des techniques d'analyse spatiale dans les prospections pratiques et l'intégration des données de sol avec d'autres données d'environnement. Il était jugé souhaitable, qu'une réunion subséquente soit organisée, consacrée à un de ces thèmes dans l'avenir prévisible.

Les actes du Colloque sont publiés en trois tomes dans la série 'SOLS' de l'Institut National Agronomique Paris-Grignon (volumes 4, 5 et 6; voir nouvelles publications de cet AISS Bulletin). On a l'intention de les publier également dans une seule volume de la série de PUDOC sur 'Soil Information Systems'.

P. A. Burrough et C. A. van Diepen, Wageningen, Pays-Bas.

ISS Working Group DP

Report on the COLLOQUIUM ON HANDLING OF SOIL DATA Paris, France, 14-17 September 1981

The ISS Working Group on Soil Information Systems met in Paris for the colloquium, organized by the French National Institute for Agronomic Research (INRA), Paris-Grignon, with assistance of the National Institute for Agricultural Research (INRA) and the International Association of Informatics and Biosphere (I&B). The meeting was attended by 72 participants of whom 38 were French, and 34 were from other countries, dominantly West and East Europe. Also the United Nations Environmental Programme (UNEP) was represented.

The papers and discussions spanned a greater range of topics than previous years reflecting current technological and scientific trends. Three main fields of interest were discernible:

a) *Soil information systems*. There was still a certain amount of discussion of the finer points of data recording and computer technology, but many participants had some experience of setting up such systems and were able to discuss their practical experience. Four groups of organizations can now be recognized:

I - those in lands where survey is complete. The information system is being used to maximize the use of soil data in land evaluation and planning.

II – those in lands where survey is half complete. The information systems are required not only for the aims of I) but also to relate new to old data and streamline production.

III – those in lands where there is yet much to do. Automation is seen as a means of improving efficiency and flexibility.

IV – those in lands that have yet to begin.

It is to be expected that most developments in the coming years will be with institutes in groups III) and IV).

The soil information systems used by the Institut National Recherche Agronomique (INRA) and ORSTOM were demonstrated. One important facet of soil information systems is that they permit statistical analysis of soil data, and several papers were able to present country-wide statistical overviews of soil data. These studies naturally raised many questions about the quality of the data that had been recorded, and the paucity of information over the levels of measurement errors, both in field and laboratory, that may well make many data unreliable, or at least impossible to compare.

b) *Spatial analysis and geostatistics.* The application of spatial analysis and geostatistics for the efficient use of soil data for pattern scale detection and spatial interpolation were presented for the first time in a European meeting.

Along with these studies came further evidence (also shown en passant in other papers and during the field excursion) of the often high short-range variability of European soil that affects all questions of land evaluation, classification and mapping.

c) *Modelling.* The interest in modelling lay mostly in trying to set up mainly deterministic models for various soil processes – mixing, clay equilibria, nitrification and water movement. In the main, these studies were totally separate from data in information systems. We are not yet so far that we can directly couple the insights gained from modelling to whole map units.

During the meeting, Dr. Stein Bie announced his retirement as Secretary of the Working Group, and also the impending retirement (at the forthcoming ISSS meeting in New Delhi in 1982) of the Chairman, Dr. ir. J. Schelling. Dr. P. A. Burrough, Department of Regional Soil Science, Agricultural University, Wageningen, was nominated as the incoming secretary, to take effect immediately with Dr. A. Moore of CSIRO, Brisbane, Australia, nominated as Chairman when Dr. Schelling retires. These positions will be ratified at the ISSS Comm. V Meeting in New Delhi. The secretary-elect moved a vote of thanks to Dr. Bie and Dr. Schelling for their work and enthusiasm in setting up the Working Group and guiding it during the first six years (1975–1981).

There was a consensus that the meeting had been useful, but there were also many aspects that deserved more detailed study. These include the role of soil information systems for developing countries, the application of spatial analysis techniques in practical survey, and the integration of soil data with other environmental data. It was thought desirable to organize a subsequent meeting devoted to one of these themes within the foreseeable future.

The Proceedings of the Meeting are published in three volumes of the Bulletin "SOLS" of the Institut National Agronomique Paris-Grignon (volumes 4, 5 and 6; see 'New Publications' of this ISSS Bulletin). Negotiations are underway to have a single-volume printing in the well-known PUDOC series on Soil Information Systems as well.

P. A. Burrough and C. A. van Diepen,
Wageningen, the Netherlands

8th Int. Symp. on Machine Processing of Remotely Sensed Data

Papers are solicited for consideration of inclusion in the 8th International Symposium on Machine Processing of Remotely Sensed Data, which will be held on the campus of Purdue University in West Lafayette, Monday, July 7-9, 1982. January 15, 1982 is the deadline for submission of paper summaries on research and/or applications in either the general area of computer-aided digital data analysis, or the specific area of Crop Inventory and Monitoring.

Summaries should be sent to: Mr. D. B. Morrison, Purdue/LARS, 1220 Potter Drive, West Lafayette, IN 47906-1399, U.S.A.

ISSS Working Group HS

INTERNATIONAL STANDARD COLLECTION OF HUMIC AND FULVIC ACIDS

The initial committee meeting of the Working Group of the International Society of Soil Science for the establishment of an International Standard Collection of Humic and Fulvic Acids was held in Denver, Colorado, on September 9-11, 1981. The meeting was jointly sponsored by the Soil Science Society of America, the U.S. Geological Survey, and the Colorado School of Mines. The committee members were Dr. Francis Andreux, France; Dr. Egil Gjessing, Norway; Dr. Mike Hayes, England; Dr. Shozo Kuwatsuka, Japan; Dr. Patrick MacCarthy, USA; Dr. Ronald L. Malcolm, USA; Dr. Morris Schnitzer, Canada; Dr. Frank Stevenson, USA; Dr. Roger Swift, New Zealand; and Dr. Paolo Sequi, Italy. The Soil Science Society of America was represented by Dr. Bobby Stewart and Dr. Matthias Stelly, President and Executive Vice-President, respectively. Other participants at the meeting included David Reckhow, Dr. Paul Ringhand, George Aiken, Dr. Mike Thurman, Dr. Jerry Leenheer, and Dr. Robert Wershaw. This meeting is the culmination of the planning portion (Phase I) of the project.

Some of the detailed aspects of the actual implementation of the Standard Collection (Phase II) which were decided at the meeting are as follows:

1. *Sample Source.* Five sources were chosen for standard samples: a mollic epipedon, the surface horizon of a Histosol, Leonardite, an aquatic dissolved sample from the Suwanee River, and a lake-bottom sediment. A possible sixth standard, a marine sample, will be added if sufficient interest is expressed to the committee. Large quantities of the bulk solid standard source materials will be taken for distribution as unextracted samples.
2. *Extraction.* A single alkaline extraction procedure, modified by XAD-8 concentration of fulvic acid, will be used for all standard samples. This detailed procedure, which was unanimously accepted by the committee will be published along with the minutes of the meeting in several journals.
3. *Standard versus Reference Samples.* The bulk source material of the solid samples and the humic and fulvic acids extracted from a representative portion of these bulk source materials by the standard extraction procedure will be designated as standard samples. The primary use of these samples will be to standardize chemical procedures for humic substances. Any additional bulk samples or large quantities of humic and fulvic acids extracted from selected samples by the standard extraction procedure or other extraction procedures will be referred to as reference samples. Of priority interest are the Armadale spodic horizon and a dissolved aquatic sample representative of northern Europe (an aquatic from Norway to be collected by Egil Gjessing).
4. *Formation of the International Humic Substances Society.* After the formal committee business was concluded, all the participants at the meeting unanimously agreed

on the formation of the International Humic Substances Society, the purpose of which is to further the study and understanding of humic substances. The first goal of the society will be to establish the Standard Collection of Humic and Fulvic Acids. Dr. Ronald Malcolm, Dr. Roger Swift, and Dr. Patrick MacCarthy were elected as President, Vice-President, and Secretary-Treasurer, respectively, of the new society. Progress is being made on incorporation and establishing the bylaws for the society.

5. *Formal Report.* The complete results of the organizational meeting and the efforts of the working group will be reported at the ISSS Congress in New Delhi.
6. *Storage and Distribution of Standards.* The collection of bulk samples and extracted humic and fulvic acids will be stored at the Colorado School of Mines in Golden. Dr. MacCarthy will compile and distribute the comparative characterization data on standard samples.
7. *Financial Support for Phase II.* A number of the participants at the meeting have volunteered considerable time and effort for the collection and extraction of a portion of the standard samples. Considerably more financial support is needed if the collection is to be a reality. Please join us in this important activity by your financial contribution and endorsement.

Address: Dr. R. L. Malcolm, U.S. Geol. Survey, M.S. 407, Denver Federal Center, Denver, CO 80225, USA.

ISSS Working group RS

Compte rendu du

III ÈME COLLOQUE "PÉDOLOGIE - TÉLÉDÉTECTION - INFORMATIQUE"

Jablonna, Pologne, 1-7 Juin 1981

Etape préparatoire

Au cours du 1er Colloque du Groupe de Travail "Pédologie et Télédétection" tenu à Rome en 1977, on a décidé d'organiser le IIIème Colloque en 1981 en Pologne. M. Stanislaw Białousz, qui était alors secrétaire du Groupe de Travail, devait assumer la responsabilité des travaux préparatoires. C'est la Société Polonaise de la Science du Sol (S.P.S.S.) et l'Institut de Géodésie Appliquée de l'Ecole Polytechnique de Varsovie qui se sont chargés d'organiser le Colloque.

Durant les travaux préparatoires, on a estimé qu'il serait très intéressant de lier le Colloque du Groupe 'Télédétection' de l'A.I.S.S. avec la session du Groupe de Travail BIGLEB de la SPSS. Cette session, consacrée à l'application des systèmes informatiques en pédologie, devrait avoir lieu en septembre 1980, mais elle a été transférée pour l'année 1981. On a donc adopté le titre 'Pédologie - Télédétection - Informatique' pour le colloque qui devrait se tenir à Jabłonna du 1er au 5 juin.

Au cours du Colloque, on a présenté 26 communications durant les sessions à Jabłonna. On a effectué des visites dans les laboratoires d'informatique et de télédétection à Varsovie et une excursion: Varsovie-Checiny-Puławy-Varsovie.

Il a été décidé de limiter le nombre de participants à 30-40 personnes car le Colloque devait être une réunion de travail. Vingt deux personnes de 12 pays ayant souhaité participer au colloque, nous avons réservé seulement 20 places pour les Polonais.

Le Programme

Du lundi 1er jusqu'au jeudi 4ème juin sept sessions ont été tenues sur les thèmes suivants: (1) Méthodologie de l'interprétation des sols à partir des données de la télédétection. (2) Caractéristiques spectrales des sols. (3) Les photographies aériennes dans la cartographie des sols. (4) Les photographies et images spatiales dans la carto-

graphie des sols. (5) Les images radar et scanner dans les études des sols. (6) Les systèmes informatiques en pédologie.

Le vendredi 5ème juin les participants, divisés en deux groupes, ont visité:

- le Centre de calculs, où ils ont fait la connaissance de listages des cartes des sols;
- le laboratoire de télédétection de l'Institut de la Géodésie et Cartographie, où ils ont pu voir les travaux effectués par les Centres de Traitement des Images Aériennes et Spatiales, ainsi que l'appareillage utilisé dans ce Centre.

L'après-midi, on est parti pour le voyage sur le terrain: Varsovie - Kielce - Checiny - Puławy - Varsovie. Au cours de ce voyage, les organisateurs ont présenté les profils des sols caractéristiques pour la zone de test 'Checiny': sol lessivé sur des couches périglaciaires, sol brun acide formé de grès, rendzine brunifiée sur calcaire jurassique, sol lessivé formé de loess. Les participants ont pu faire la connaissance de principes méthodologiques de l'interprétation des sols dans cette zone et voir les photographies aériennes représentant ce terrain. Pendant le trajet Kielce - Puławy, on a présenté aux participants les principes méthodologiques des travaux effectués dans la station expérimentale 'Grabów' par l'Institut de la Géodésie et Cartographie et l'Institut de Pédologie. On a analysé le profil du sol lessivé à pseudogley et on a discuté des problèmes pédologiques. L'Institut de Pédologie à Puławy a fait connaître aux participants divers travaux cartographiques: à partir des cartes agro-pédologiques au 1:5000 jusqu'aux cartes de valorisation de terrains agricoles, valables pour l'ensemble du pays et différentes régions.

C'est dans cet Institut qu'a eu lieu la clôture officielle du Colloque.

Conclusions révélant des rapports et des discussions

Les documents de base pour l'étude des sols par la télédétection

On a présenté divers documents de base pour l'interprétation: photographies aériennes panchromatiques, infrarouge en noir et blanc, en couleurs et fausses couleurs, multispectrales, images aériennes de scanner enregistrées sur bande magnétique et sur pellicule, images aériennes de radar, images de scanner du satellite Landsat, photographies spatiales multispectrales prises par la caméra MKF 6 et photographies des satellites 'Cosmos'. La discussion a montré que les photographies multispectrales sont de plus en plus souvent l'objet de recherches approfondies.

La caractéristique spectrale des sols

D'après deux communications présentées et la discussion qui les a suivies, on peut déduire que le passage de la caractéristique spectrale des sols à l'interprétation automatique n'est pas encore tout à fait possible. A l'échelle d'une région, s'il y a des sols dont la caractéristique spectrale est nettement différenciée, il est facile de trouver des exemples d'une compatibilité entre les images des sols sur les photographies et leurs caractéristiques spectrales.

Pour de petites surfaces et des échelles plus grandes, il n'y a pas que les paramètres de propriétés constantes du sol qui interviennent dans la caractéristique spectrale des sols. On y voit avant tout l'influence de la rugosité de la surface mais aussi l'influence de son humidité temporaire. Il faut également procéder à une comparaison entre les caractéristiques spectrales obtenues au laboratoire, les mesures spectrales effectuées sur le terrain, et les mesures aériennes et spatiales.

Les méthodes d'interprétation

Au cours de la discussion, on a souligné que la méthode complexe d'interprétation du paysage joue toujours un rôle très important. Tous les participants étaient d'accord sur ce point-ci: on ne peut pas élaborer des cartes de sols en s'appuyant uniquement sur l'interprétation des images sans effectuer de travaux sur le terrain. Ensuite,

on s'est posé le problème de la densité optimum des points d'observation.

Il est évident que le renouvellement d'une carte nécessite une tout autre précision que l'élaboration d'une nouvelle carte. Si on utilise des données de la télédétection pour élaborer une carte des sols, on a plus affaire à la résolution de la carte qu'à sa précision.

En ce qui concerne la méthodologie de l'interprétation des photographies multi-spectrales, on a examiné les possibilités de différents canaux et les critères de choix des canaux permettant d'obtenir les compositions colorées qui rendraient le mieux la différenciation des sols.

Dans le domaine de techniques photographiques, le traitement numérique des images possèdent de grandes possibilités d'adapter la classification aux divers besoins.

Les conclusions résultant du voyage sur le terrain

A part les discussions sur les méthodes d'interprétation, il est aussi important de discuter au sujet de cette interprétation, c'est-à-dire sur les sols et leur milieu.

Dans la zone de test 'Checiny', les profils de sols ont permis d'échanger les opinions sur la classification des sols et la terminologie, et d'indiquer les rapports existant entre le paysage et les sols et entre les sols et leurs images sur différents types de photographies.

Grâce à la vulgarisation de la classification des sols de la FAO et aux grandes ressemblances des principes de classification dans différents pays, il n'y avait pas de différences dans l'interprétation des profils présentés. La plus vive discussion a eu lieu près du profil du sol lessivé à Grójec. On a discuté sur le rôle des processus périglaciaires dans la formation du substratum et sur le rôle de processus 'dermo'. On a aussi vivement discuté, près du profil du sol lessivé à pseudogley, les problèmes de pseudogleyification, de gleyification de nappe phréatique, des changements de profil causés par la culture intensive. Autour de ce dernier profil, on a pu observer le phénomène de battance de la surface, qui devient une marque d'interprétation très importante.

Conclusions finales concernant les travaux du groupe de travail

Au cours de la discussion finale, nous avons constaté que les échanges d'expériences et d'opinions sous la forme de colloque donnaient de bons résultats. M. M-C. Girard dans son discours de clôture, a souligné qu'il faudrait continuer cette forme de travail. Après avoir examiné de nombreuses propositions, nous avons décidé de demander à M. F. Hilwig d'organiser le IVème Colloque en 1984 aux Pays-Bas, en profitant des moyens de l'I.T.C. Le lieu du Vème Colloque sera fixé ultérieurement, probablement pendant le congrès de l'Association Internationale de la Science du Sol qui se tiendra aux Indes en 1982. Etant donné les frais importants, seulement un petit nombre de participants au 3ème Colloque se rendra aux Indes. Il faudrait conserver le Groupe de Travail au sein de la Commission V et prendre les mesures prévues par le règlement de l'AISS, pour que ce Groupe devienne sous-Commission.

On a aussi discuté une autre question de grande importance. Il s'agit d'échanges de bibliographies et d'informations. Dans chaque pays, ce seront les correspondants qui se chargeront de cette tâche. Les informations recueillies pendant quelques années seront publiées sous la forme de brochure. On les transmettra aussi aux centres informatiques de documentation (agronomie, pédologie et télédétection).

On recommande aux correspondants d'envoyer au secrétaire du Groupe de travail les listes des bibliographies correspondant aux années 1978-1979, au plus tard jusqu'au mois de septembre 1981.

Les documents du IIIème Colloque seront publiés dans le cahier spécial des Annales Pédologiques de la Société Polonaise de la Science du Sol.

S. Bialousz, Varsovie, Pologne

IN MEMORIAM

Dr. Guy Donald Smith (1907–1981)



Guy Donald Smith, former President of the Soil Science Society of America and former Director of Soil Survey Investigations for the Soil Conservation Service, U.S.D.A., died August 22, 1981, at his home in Ghent, Belgium.

Dr. Guy Smith was born June 20, 1907 at Atlantic, Iowa. He was awarded the degree of Bachelor of Science by the University of Illinois in 1930, Master of Arts by the University of Missouri in 1934, and Doctor of Philosophy by the University of Illinois in 1940. His career in soil science began as Assistant in soil survey and soil physics at the University of Illinois from 1930 to 1934. He was Head of Land Acquisition of the Resettlement Administration for Illinois, Region III from 1934 to 1936, and Associate then Assistant Professor of soil physics and soil survey for the University of Illinois from 1935 to 1942. He served in the U.S. Army Air Force during World War II from 1942 to 1946. In 1946, he joined the Soil Survey Division of the Bureau of Plant Industry, Soils, and Agricultural Engineering, U.S.D.A. as Senior Soil Correlator at Ames, Iowa. In 1950, he was made Principle Soil Correlator for the Upper Mississippi Valley.

In 1952, when the Soil Survey Division was transferred to the Soil Conservation Service, Dr. Smith became Director of Soil Survey Investigations for the nation and held that position until his retirement in 1972. After retirement, he served as Visiting Professor at the University of Ghent, Belgium, a position he held until his death.

Four of Dr. Smith's many publications are noted as outstanding contributions that characterize the development of his career. His study of claypans and the translocation of clay in soils, published as Missouri Agricultural Experiment Station Research Bulletin 210 in 1934, brought him recognition as a pedologist. His stature as a soil scientist was firmly established by his landmark study of pedologic interpretations of the properties and distribution of Illinois loess, published as Illinois Agricultural Experiment Station Bulletin 490 in 1942. This became a model for studies of soil genesis in the Midwest. His role as soil correlator for the Soil Survey is characterized by the article 'Prairie Soils of the Upper Mississippi Valley', in *Advances in Agronomy*, 1950, of which he was senior author. Finally, 'Soil Taxonomy' published in 1975 as *Agriculture Handbook 436* was the culmination of 23 years of his leadership of a project to develop a new comprehensive system of taxonomic soil classification. That work brought him international recognition, perhaps more wide-spread than that of any pedologist to this time.

Dr. Smith held the Francquire Chair at the University of Ghent, Belgium in 1964–65 for collaboration with European soil scientists in the development of Soil Taxonomy. After retirement, he consulted widely on application of the system, including service as Correlator in Trinidad for the Organization of American States (1973–74), Correlator for Centro Nacional de Investigaciones Agropecuarias in Venezuela (1975–76), and as Soil Scientist of the Soil Bureau of New Zealand (1976–77). He had recorded oral explanations of Soil Taxonomy on an assignment in the United States and was editing the transcription at his death.

Dr. Smith was active in several professional societies. He was a Fellow of the American Society of Agronomy and an Honorary Member of the Soil Science Soci-

ety of America. He served the latter as Vice-president in 1958 and as President in 1959; he received the Soil Science Achievement Award in 1964. He was Vice-chairman of the Committee of Tours for the 7th International Congress of Soil Science and was a member of the Committee of the Soil Science Society of America for organizing that Congress.

Survivors include his wife, Yolanda Bultyn Smith, and five children by former marriage: Ann Spurgen, Lisa Brodyaga, Guy Jr., Randall, and Arthur.

Marlin G. Cline, Ithaca, USA

Mr. L. Vettori (1915–1981), Honorary Member of ISSS

On July 30, 1981, Brazilian soil science suffered a heavy loss by the passing away of Dr. L. Vettori.

Mr. Vettori contributed considerably to the development of soil testing methods in his country and to the study of soil fertility in tropical regions.

This work received recognition in 1966 through an award of the International Soil Testing Association.

Mr. Vettori served on many commissions and workshops of the commerce of fertilizers and correctives and for coordination of the national program of soil analysis in Brazil.

Mr. Vettori is a founding member of the Brazilian Society of Soil Science, created in 1947, where he served as President from 1957–1959. He was elected Honorary Member of ISSS in 1978.

Francisco da Costa Verdade, Campinas, Brazil

Prof. R. Earl Storie (1894–1981)

R. Earl Storie, international consultant in soils and emeritus professor in plant and soil biology at the University of California, Berkeley, USA died March 23, 1981, at the age of 87 in Berkeley.

Professor Storie gained worldwide attention as the originator of the 'Storie Index', a method of measuring various soils' capacities for supporting plant growth. The index has been used around the world by agricultural experts, ecologists, and bankers who required an index rating report before lending on farmland.

A native of Waitsburg, Wash., R. E. Storie earned his B.A. in 1917 from the University of California, served as an Army Air Corp. pilot during World War I, and then worked as a hydrographer for the Californian Division of Water Resources. He joined the Department of Soil Technology and Soil and Plant Nutri-

tion of the University of California in 1921.

He headed the university's Soil Survey Program from 1939 until his retirement in 1960, after 40 years of teaching at the Davis and Berkeley campuses. He had been a United Nations' consultant on soil science in Egypt and Bolivia and made study tours through Europe, Latin America and Sout-East Asia.

Prof. Storie published 140 scientific articles. His 'Index for Rating the Agricultural Value of Soils' was first published in 1933 and was followed by 'Natural Land Type Classification', 'Evaluating Land for Timber', 'Evaluating Land for Irrigation', and others. A complete collection of his publications, together with his files on soils of California and of the World at large, can be studied at the R. Earl Storie Collection at the University of Wyoming's American Heritage Center.

Prof. Storie was a long-time member of the International Society of Soil Science and the Soil Conservation Society of America. In 1972 he was named a Honorary Member of the latter Society.



NEWS FROM THE NATIONAL AND REGIONAL SOCIETIES
NOUVELLES DES ASSOCIATIONS NATIONALES ET REGIONALES
BERICHTE DER NATIONALEN UND REGIONALEN GESELLSCHAFTEN

Deutsche Bodenkundliche Gesellschaft (DBG)

Die Jahrestagung 1981 der DBG fand gemeinsam mit einem internationalen Symposium von 06.09.1981–12.09.1981 in Berlin statt.

Das Generalthema lautete: *Bodenkundliche Probleme städtischer Verdichtungs-räume*.

An der Jahrestagung und am Symposium nahmen 320 Bodenkundler aus 18 Ländern teil; es wurden 130 Vorträge gehalten. 11 Fachexkursionen und eine Ausstellung ergänzten das Vortragsprogramm.

Ein Exkursionsführer liegt als Band 31 der Mitteilungen der DBG (352 Seiten) vor; die Vorträge werden in einem Doppelband 32 der Mitteilungen dokumentiert.

Auf der Mitgliederversammlung wurde ab 01.01.1982 ein neues Präsidium gewählt:

Präsident: Prof. Dr. K. H. Hartge, Institut für Bodenkunde, Hannover
Vizepräsident: Prof. Dr. H. Kuntze, Bodentechnologisches Institut, Bremen
Vizepräsident: Prof. Dr. H. Zakosek, Institut für Bodenkunde, Bonn

Die Geschäftsstelle wird weiterhin geleitet von Prof. Dr. B. Meyer, Institut für Bodenkunde, D-3400 Göttingen, von-Siebold-Straße 4.

Soil Science Society of Southern Africa

The Society held its tenth Biannual Meeting in East London, from 29th June to 3rd July 1981. The first plenary session which was under the chairmanship of Prof. J. M. de Villiers, President of the Society, was opened by the Honourable Dr. L. L. Sebe, Chief Minister of the Ciskei and the theme of his address was: 'Soil Science and its role in the development of the Ciskei'. Prof. A. R. van Wambeke of Cornell University USA presented the keynote address on 'Soil Classification and Mapping' and a special paper was presented by Dr. H. v. H. van der Watt of the Science Planning Branch, Office of the Prime Minister, RSA entitled 'Resources devoted to research and development in the field of soil and plant production science in the RSA'. Thirty five papers were presented including for the first time a poster session of 7 posters. One hundred and thirty members of the Society attended the meeting which also elected its new Board for the 1981/82 period:

President: Prof R. du T. Burger
Vice-President: Dr. C. N. MacVicar
Secretary/Treasurer: Dr R. W. Fitzpatrick
Members: Prof. R. O. Barnard, Prof M. C. Laker, Prof E. Verster, and Prof H. v. H. van der Watt

The Conference was followed by a field trip to Keiskammahoe development project, Hogs-back and Fort Hare University (Alice). The Conference expressed special thanks to the Organizing Committee and particularly to Prof. Laker and Mr. Hensley for the excellent arrangements made for the Conference. The proceeding of this Conference will be published.

The next Conference will be held jointly with the South African Society of Crop Production and the Grassland Society of Southern Africa in January, 1983 in Cape Town.

Indian Society of Soil Science

The 46th Annual Convention and the Annual General Meeting of the Indian Society of Soil Science was held at the Indian Agricultural Research Institute, New Delhi from August 7-9, 1981.

The 8th Dr. R. V. Tamhane Memorial Lecture was delivered on the inaugural day by Dr. D. R. Bhumbra on the topic 'Land and water management in relation to agricultural production'. The three-day Scientific Session organised during the convention was oriented towards the theme of the forthcoming 12th International Congress of Soil Science (Feb. 1982) i.e. '*Managing Soil Resources to Meet the Challenge to Mankind*'. There were 45 papers for oral presentation and 118 for poster sessions in the seven approved commissions of the ISSS which were very well attended and evoked much of interest and lively discussion as a prelude to the 12th Congress to be hosted by this Society for the first time in this part of the globe.

The following were elected as office-bearers for 1981-1982 at the 46th Annual General Meeting of the Indian Society of Soil Science held on August 9, 1981.

President: Dr. N. S. Randhawa
Vice-Presidents: Dr. T. D. Biswas, Dr. J. S. P. Yadav and Dr. S. S. Prihar
Secretary: Dr. A. B. Ghosh
Joint Secretary: Dr. N. N. Goswami
Asstt. Secretary: Dr. T. N. Chaudhary
Treasurer: Dr. G. Narayanasamy
Members: Dr. B. K. Khosla, Dr. O. P. Meelu, Dr. Jagan Nath, Dr. P. K. Omanwar, Dr. S. R. Poonia, Mr. H. S. Shankaranarayana, Dr. N. T. Singh, Dr. B. R. Tripathi, Dr. G. P. Bhargava, Dr. P. K. Chhonkar, Dr. D. K. Das, Dr. J. C. Katyal, Dr. S. S. Khanna, Dr. Raj Pal, Dr. A. K. Sharma, Dr. I. V. Subba Rao

The Vth Czechoslovak Conference of Soil Science, with international participation

The Czechoslovak soil scientists regularly organize their Conferences with the participation of foreign experts. The 5th of such Conferences took place in Prague, August 18-23, 1981. Both the national and the international interest for the meeting were considerable: 122 colleagues participated in it, of which more than 25 foreign guests, representing 13 countries.

The Conference dealt with the most important pedological problems of agriculture, silviculture, land reclamation, water management and environmental protection. The more than 50 papers that were presented clearly indicated the development of the Czechoslovak soil science during the 20 years of the great project of complex soil survey in the country, which programme terminated this year. The meeting appreciated this programme not only as the largest during the whole history of the Czechoslovak soil science, but also as the most useful for practical agriculture.

As follow-up of this programme now research will be extended and methods will be elaborated in order to study and to describe the processes determining and limiting soil fertility. Such type of studies will make it possible to elaborate new technologies for soil improvement.

At the Conference the environmental effect of application of chemicals and new machinery in agri- en silviculture was also discussed. Several papers dealt with the adverse effects of large-scale technologies on the pedo-, hydro- and biosphere, and with the methods for prediction and prevention of such effects.

The following topics were outstanding among the papers presented:

- soil classification and interpretation of soil maps and surveys
- importance of structure of soil cover
- diagnostics of soil properties important for technology and in relation to the envi-

ronment; diagnostics of soil forming processes with particular regard to soil productivity, improvement and protection

- processes controlling soil fertility like the transformation of plant nutrients; the leaching and accumulation of polluting substances; and the nutrient cycling in forest ecosystems
- unsaturated water flow in extremely heavy soils
- transformation of soils organic matter and nitrogen
- transport of sediments and adsorbed nutrients
- contamination of soils with biocides and heavy metals, as well as contamination of the hydrosphere with nitrates.

The Conference was followed by two professional excursions on August 22 and 23 to the localities Vocado-Salacova and Lhota-Zelivka and the district of Melnik-Tupadly.

The excellent organization of the Conference as well as of the excursions and the kind hospitality offered by the hosts made the meeting memorable for all.

The IIIrd National Conference of the Bulgarian Soil Science Society

The Bulgarian Soil Science Society organized its IIIrd National Conference jointly with the Pushkarov Institute for Soil Science and Yield Prediction in Sofia, 21-23 Sept. 1981. The meeting celebrated also the 70 years anniversary of Bulgarian Soil Science.

The Inaugural Plenary Meeting of the Conference was held on 21 Sept. in the Auditorium of the Pushkarov Institute, after the opening by Cz. Chinkovsky, President of the Bulgarian Agricultural Academy, Prof. L. Raikov, the President of the Bulgarian Soil Science Society, delivered his paper on the 70 years of activity of the Bulgarian Soil Scientists. He stressed the achievements of N. Pushkarov, who was the founder of modern Soil Science in Bulgaria, as well as the activity of his successors. Particular attention was given to the actual problems of pedology and related sciences regarding the demands of practical agriculture and land conservation. Also at the first plenary session were presented papers on important problems and results of Bulgarian Soil Science:

Sl. Kristanov and M. Iolevsky: Soil Resources of Bulgaria and the Methods for their Utilization.

M. Milcheva and E. Neikova: Alteration of Soil Under the Influence of Intensive Farming.

N. Ognev and N. Shopsky: The Methods for Increasing the Fertility of Soils of Low Productivity.

Apart from the plenary sessions nearly 100 papers were presented by Bulgarian Soil Scientists at the meetings of five standing commissions.

The papers and active discussions gave a good picture of the recent problems in Bulgarian Soil Science. The motto of the Conference was: 'Utilization and conservation of soil resources in conditions of intensive agriculture', which was reflected in the topics of papers presented in plenary as well as at the Commission Meetings.

Dr. L. Raikov was re-elected as President of the Bulgarian Soil Science Society for the next term. Three days of excursion followed the Conference, with as route: Sofia - Chiren - Gorni - Dubuk - Pleven - Turia - St. Zagora - Belozem - Plovdiv - Sofia. During this round trip different soils of the country were demonstrated, and farms and research stations were visited. The participants had a good opportunity to observe the achievements of Bulgarian Agriculture both in experimental fields and in production. They also enjoyed the beauty of the country and the hospitality of the hosts.

I. Szabolcs, Budapest, Hungary

**INTERNATIONAL RELATIONS
RELATIONS INTERNATIONALES
INTERNATIONALE VERBINDUNGEN**

LES PROCESSUS DE TRANSFORMATION DES TERRES

Un projet du Comité Scientifique pour les Problèmes de l'Environnement (SCOPE)

Le Comité Scientifique pour les Problèmes de l'Environnement (SCOPE) est un Comité international non gouvernemental, sans but lucratif, créé en 1969 par le Conseil International des Unions Scientifiques. Il identifie des problèmes environnementaux d'intérêt global et s'efforce de contribuer à leur compréhension et au progrès des connaissances à leur sujet en effectuant la synthèse et l'évaluation de l'information scientifique sur les problèmes auxquels il porte attention, en diffusant les résultats acquis et en identifiant les lacunes dans les connaissances.

L'un des plus récents projets que le SCOPE a inscrit à son programme porte sur les processus de transformation des terres. En effet, que ce soit dans les pays industrialisés comme dans ceux en voie de développement, les terres subissent à un rythme croissant une transformation rapide et étendue, due à diverses activités humaines. Par exemple de grandes surfaces agricoles sont soustraites à d'autres usages pour servir de support à des activités industrielles et urbaines.

L'agriculture possède par ailleurs des effets qui lui sont propres en raison de l'utilisation de nouvelles techniques ou de nouvelles pratiques agricoles liées à l'intensification de l'agriculture. Lorsqu'elles sont appliquées sans discernement, elles peuvent entraîner une diminution de l'humus, une détérioration des propriétés physiques du sol, une modification de l'activité microbienne et des processus biochimiques qui lui sont associés, etc..., et finalement une transformation néfaste des terres.

Pour répondre aux besoins de tous ceux qui se préoccupent de la gestion rationnelle de l'environnement, le SCOPE a entrepris actuellement une étude analytique ayant pour objet d'identifier les processus de transformation des terres, d'étudier leurs causes physiques et économiques, leurs effets y compris leur réversibilité, et les méthodes pour déterminer les vitesses de changement. Il espère, par le biais d'une étude analytique comparative, définir des critères scientifiques qui permettraient d'identifier et de mesurer l'étendue et le caractère des différentes transformations des terres qui se manifestent de par le monde, et d'en faire leur monitoring.

Le SCOPE a choisi, dans un premier stade de son approche, de réunir, à partir d'expériences nationales, un certain nombre d'études de cas significatifs répartis dans les différents milieux du globe. Jusqu'à présent, 19 Comités Nationaux du SCOPE et autres groupes de scientifiques ont répondu à l'attente mise en eux. Ce sont ceux des pays suivants:

Afrique du Sud – Australie – Bulgarie – Côte d'Ivoire – Egypte – Espagne – Etats-Unis – France – Ghana – Grande-Bretagne – Hongrie – Inde – Indonésie – Israël – Japon – Nouvelle-Zélande – Pays-Bas – République Fédérale d'Allemagne – Tchécoslovaquie.

Par ailleurs deux pays, la France et les Etats-Unis, ont procédé à une analyse plus approfondie d'une partie du problème par le biais d'un Colloque: Colloque sur la transformation du sol et la productivité (Etats-Unis, octobre 1980); Colloque sur l'agriculture et la transformation des terres (France, mars 1981).

Enfin, grâce à la coopération avec l'Union Géographique Internationale, un Colloque UGI/SCOPE vient de se tenir en Hongrie (Veszprem, septembre 1981), sur les effets de l'industrialisation et de l'urbanisation sur la transformation des terres dans l'espace rural.

L'examen de l'ensemble des contributions reçues jusqu'à présent par le SCOPE, ainsi que celui des titres des trois Colloques qui se sont tenus, révèle qu'une attention prioritaire a été portée aux processus de transformation des terres en agriculture et dans l'espace rural. C'est donc dans ce domaine que le SCOPE oeuvrera dans un premier temps, se consacrant ultérieurement à d'autres domaines.

Le Project du SCOPE possède un Comité Scientifique Consultatif placé sous la présidence du: Prof. Gordon Wolman, Department of Geography, The Johns Hopkins University, Baltimore, Maryland 21218, U.S.A.

F. Fournier, Paris, France

Mountain Research and Development

*The International Mountain Society is a new society, recently incorporated in the State of Colorado (United States) as a non-profit-making organization, dedicated to achieving a better balance between human welfare, the mountain environment and development of resources. The term 'mountain' is interpreted by the society to include uplands and steep slopes at lower elevations, which influence life-support systems for about 400 million people and affect the welfare of many millions more. The society has evolved from the work of numerous international organizations, including IGU's Commission on Mountain Geoecology, Unesco's Man and the Biosphere Programme, the United Nations University Programme on Natural Resources, and the International Union for the Conservation of Nature and Natural Resources. It will foster interdisciplinary research and international collaboration for the solution of such problems as population pressures on mountain lands, mismanagement of both renewable and nonrenewable resources, deforestation and uncontrollable growth of tourism. A quarterly scientific journal entitled *Mountain Research and Development*, co-published with the United Nations University and supported by Unesco, will be sent to all society members. Please address inquiries to: International Mountain Society, P.O. Box 3148, Boulder, CO 80307, United States.*

Swedish Soil Scientist appointed new Director of ICRAF

The Board of the International Council for Research in Agroforestry (ICRAF) in Nairobi, Kenya, appointed ISSS member Dr. Bjorn Lundgren as the new Director of the Council. He has taken up this new duties on 1st September 1981.

Dr. Lundgren comes from Sweden. He holds M. Sc. and Ph. D. degrees in Forestry from the Royal College of Forestry (Stockholm) and the Swedish University of Agriculture Sciences (Uppsala) respectively.

His fields of specialization are tropical forest soils and land evaluation and he has particularly studied the effect of plantation forest management on soils in the northern Tanzanian highlands. For a period of two years, in 1972-74, he was a Lecturer in Forest Biology at Makerere University, in Uganda and at the Faculty of Agriculture and Forestry in Morogoro, Tanzania. Since 1978 he has worked as a consultant in Tropical

Forest and Land Development with the Swedforest Consulting Company. He has travelled extensively in the tropics and has been engaged in projects in Central America, East and West Africa, and Sri Lanka.

ISSS congratulates Dr. Lundgren with his appointment and wishes him much success.



'L'ÉCOLOGIE EN ACTION: RECHERCHE D'UNE BASE SCIENTIFIQUE POUR L'AMÉNAGEMENT DU TERRITOIRE'

Conférence scientifique internationale marquant les 10 ans du Programme MAB de l'Unesco

Il y a 10 ans, l'Unesco lançait son Programme international et interdisciplinaire de recherche sur l'Homme et la Biosphère 'en vue de faire progresser la connaissance scientifique et d'accroître la formation d'un personnel qualifié pour mieux gérer les ressources naturelles'.

Au cours de sa première décennie d'existence, le Programme a reçu l'appui d'une large gamme de spécialistes et d'organisations, y compris de spécialistes en sciences sociales et de décideurs. De nombreux projets, pour la plupart inspirés de priorités nationales, ont été conduits mais dans un esprit nouveau: l'approche interdisciplinaire et intégrée des problèmes, avec des finalités d'application.

Après 10 ans, il était nécessaire de passer en revue et d'évaluer les activités de recherche et de formation du MAB, et de recommander des axes futurs d'activité à la lumière des problèmes critiques mondiaux d'environnement, actuels ou prévisibles. Ce sont pour ces raisons que s'est tenue au Siège de l'Unesco, à Paris, du 22 au 29 septembre 1981, une Conférence scientifique internationale: 'L'Écologie en Action: Recherche d'une base scientifique pour l'aménagement du Territoire'.

Elle a été organisée conjointement par l'Unesco et le Conseil International des Unions Scientifiques (CIUS). Elle a attiré la participation de près de 380 scientifiques originaires de 67 pays.

La première partie de la Conférence s'est concentrée sur quatre thèmes principaux:

- la recherche de systèmes de production soutenue dans les tropiques humides et sub-humides,
- les bases scientifiques de l'aménagement des terres à pâturage et des zones marginales,
- la recherche d'un fondement de la conservation des écosystèmes,
- les approches écologiques pour l'amélioration de la planification urbaine.

Une journée entière a été consacrée à chaque thème, introduite par une revue de synthèse. Elle a comporté ensuite la présentation d'études de cas et d'une ou deux communications sur des problèmes sélectionnés et les tendances d'actions dans le futur.

Par ailleurs, trois sessions spécifiques ont pris place: l'une consacrée à l'utilisation de l'information scientifique à des fins d'éducation relative à l'environnement; la seconde à la 'fourniture des types d'information nécessaires à la prise de décision sur l'aménagement du territoire'; et enfin une dernière consacrée aux 'défis et problèmes prioritaires dans les années 1980'.

Il convient de signaler qu'à la Conférence scientifique internationale 'L'Écologie en Action' était associée une Exposition décrivant visuellement le rôle des recherches et des activités de formation du MAB pour résoudre des problèmes d'aménagement du territoire. Elle a été organisée autour de 36 affiches en couleur et vise à être un moyen de communication permanent entre scientifiques, décideurs et politiciens et à être utilisée à des fins d'éducation relative à l'environnement.

Elle a compris cinq principales sections:

- la recherche pour l'aménagement du territoire - composants, stratégie, obstacles (10 affiches);
- la forêt tropicale - richesse vulnérable (7 affiches);
- les terres marginales - tourner les obstacles en avantages (7 affiches);
- les villes comme systèmes écologiques (7 affiches);
- la conservation - comment, où et pourquoi (5 affiches).

L'exposition est de forme modulaire. Chaque affiche ou chaque groupe d'affiches peut être utilisé indépendamment si on le souhaite. L'exposition a été conçue de façon à pouvoir être reproduite en multiples copies, en différentes langues, sous une forme qui la rende aisément transportable, aisée à monter et utilisable par les pays en l'adaptant à leurs contextes écologiques, socio-économiques et culturels.

Il est donc espéré que les Comités nationaux du MAB et les institutions nationales qui collaborent à ce Programme, organiseront des expositions nationales en utilisant comme base, soit tout, soit partie de l'exposition-MAB qu'ils compléteront avec des matériaux audio-visuels dans leur propre langue, montrant des exemples locaux ou nationaux.

Une version anglaise de l'exposition a été exposée à l'Unesco pendant la Conférence.

Un exemple de ce qui peut être fait a été fourni par l'utilisation de la version française par la Municipalité de Paris à l'Hôtel de Ville de Paris. Elle a fait partie d'une exposition plus large portant sur le thème 'La terre entre vos mains' et organisée sous l'égide de la Commission Nationale française pour l'Unesco avec la participation du Ministère de l'Environnement et d'autres institutions nationales. Une sélection d'affiches Unesco-MAB a été enrichie et complétée par d'autres affiches et d'autres matériaux audio-visuels, illustrant des exemples de la participation des scientifiques français aux projets de MAB sur le terrain, tant en France qu'ailleurs. L'exposition de l'Hôtel de Ville de Paris est ainsi le premier exemple de la façon dont l'exposition Unesco-MAB peut être utilisée et adaptée par un groupe national pour un certain public national.

Le Museum International des Sols, dont le Siège est à Wageningen (Pays Bas), a joué un rôle notable dans cette exposition en présentant des profils de sol assortis de textes explicatifs, se rapportant aux écosystèmes et aux problèmes illustrés par les affiches. Il a montré en outre comment le Programme MAB bénéficie de l'activité de spécialistes de science des sols.

Les conclusions et recommandations de la Conférence scientifique ont été mis à la disposition de la 7ème Session du Comité International de Coordination du Programme MAB, qui l'a suivie immédiatement, du 30 septembre au 2 octobre 1981.

F. Fournier, Unesco, Paris

**MEETINGS, CONFERENCES, SYMPOSIA
REUNIONS, CONFERENCES, SYMPOSIUMS
TAGUNGEN, KONFERENZEN, SYMPOSIEN**

Meetings etc., marked with*, are organized or sponsored by the ISSS /Réunions etc., indiquées avec*, sont organisées ou favorisées par l' AISS/Tagungen usw., angezeigt mit*, werden organisiert oder unterstützt von der IBG.

1982

***12th International Congress of Soil Science: Managing Soil Resources to Meet Challenge of Mankind**, New Delhi, India, 8–16 February 1982.

Information: N. N. Goswami, Organizing Secretary 12th International Congress of Soil Science, Division of Soil Science & Agricultural Chemistry, Indian Agricultural Research Institute, New Delhi-110012, India.

First International Symposium on Soil, Geology and Landforms – Impact on Land Use Planning in Developing Countries, Bangkok, Thailand, 1–3 April 1982.

Information: Dr. Prinya Nutalaya, Symposium Secretary, Landplan 1, Asian Institute of Technology, P.O. Box 2754, Bangkok, Thailand.

Meeting on Soils, Pests and Diseases, London, April 1982, joint meeting BSSS and British Society for Plant Pathology.

Information: Dr. D. V. Crawford, University of Nottingham, School of Agriculture, Sutton Bonington, Loughborough LE12 5RD, U.K.

Symposium on Changes in the Earth's Surface as Revealed by a Decade of Observations from Space, Ottawa, Canada, 17–29 May 1982, COSPAR.

Information: COSPAR, 51 Bd de Montmorency, 75016 Paris, France.

13th European Regional Conference of the ICID, Lisbon, Portugal, May-June 1982.

Information: ICID, 48 Nyaya Marg, Chanakyapuri, New Delhi-11021, India.

Symposium on Role of the Unsaturated Zone in Radioactive and Hazardous Waste Disposal, Philadelphia, Pennsylvania, USA, 31 May–4 June 1982.

Information: Dr. James W. Mercer, American Geophysical Union – Geo Trans, Inc., P.O. Box 2550, Reston, VA 22090, USA.

International Symposium on Hydrometeorology, Denver, Colorado, USA, 13–17 June 1982.

Information: Robert A. Clark, Office of Hydrology, National Weather Service, NOAA, Silver Spring, Maryland 20910, USA.

2nd Scientific Meeting of the Recultivation of Technogenous Landscapes, Gyöngyös, Hungary, 15–17 June 1982.

Information: Dr. E. Bakondi-Zámory, Secretary, Centre of Plant Protection and Agrochemistry, P.O. Box 127, Budapest, Hungary.

9th Conference of the International Soil Tillage Research Organization (ISTRO), Osijek, Yugoslavia, 21–25 June 1982. General theme: 'Ameliorative Tillage'.

Information: Prof. V. Mihalić, University of Zagreb, Faculty of Agriculture, Simunska cesta 25, 41000 Zagreb, Yugoslavia.

2nd International Seminar on Laterite Research, IGCP Project no. 129, São Paulo, Brazil, 4–12 July 1982.

Information: Dr. A. J. Melfi, Inst. de Geociencias, Univ. de São Paulo, C.P. 20899, São Paulo, Brazil.

or: Mr. E. H. von Braun, Executive Secretary IGCP programmes, Unesco, 7 Place de Fontenoy, 75700 Paris, France.

8th International Symposium on Machine Processing of Remotely Sensed Data, Purdue University in West Lafayette, Indiana, USA, 7–9 July 1982.

Information: Mr. D. B. Morrison, Purdue/LARS, 1220 Potter Drive, West Lafayette, IN 47906–1399, USA.

4th International Conference on Permafrost, Fairbanks, Alaska, 18–22 July, 1982.

Information: Executive Secretary, Polar Research Board, National Academy of Sciences, 2101 Constitution Avenue NW, Washington DC 20418, USA.

11th Congress of the International Union of Quaternary Research (INQUA), Moscow, USSR, 1–9 August 1982.

Information: Secretary-General 11th INQUA Congress, Geological Institute, USSR Academy of Sciences, Pyzhevsky 7, Moscow 109017, USSR.

27th International Geological Congress, Moscow, USSR, 4–14 August 1984.

Information: Secretariat 27th IGC, Lithosphere Institute, 22 Staromonetny per., 109 180 Moscow, USSR.

9th International Colloquium of Plant Nutrition, Warwick, England, 22–28 August 1982.

Information: Dr. M. A. Scaife, NVRS, Wellesbourne, Warwick, CV35 9EF, U.K.

Symposium on Weathering, Soils and the Sedimentary Cycle, McMaster University, Ontario, Canada, 22–28 August 1982.

Information: Dr. L. J. Evans, Department of Land Resource Science, University of Guelph, Ontario, N1G 2W1, Canada.

***7th International Colloquium of Soil Zoology**, Louvain-la-Neuve, Belgium, 30 August–2 September 1982.

Information: Prof. Ph. Lebrun, Ecologie animale, Place Croix du Sud 5, B1348 Louvain-la-Neuve, Belgium.

2nd International Symposium on N₂-fixation with Non-legumes, Banff, Alberta, Canada, 5–10 September 1982.

Information: Dr. R. J. Rennie, CAN-FIX, Box 7000, Lethbridge, Alberta, T1J-4A9 Canada.

Autumn Meeting and A.G.M. of the British Society of Soil Science. Theme: The Changing Landscape, Aberystwyth, 13–16 September 1982.

Information: Dr. D. V. Crawford, University of Nottingham, School of Agriculture, Sutton Bonington, Loughborough LE12 5RD, U.K.

19th General Assembly of the ICSU, Cambridge, U.K., 20–24 September 1982.

Information: Secr. General, ICSU, 51 Bd. de Montmorency, 75016 Paris, France.

12th Congress of the International Association of Sedimentologists, Hamilton, Ontario, Canada, September 1982.

International Symposium on Polders of the World, Agora, Lelystad, Netherlands, 4–9 October 1982.

Information: Ir. J. Lujendijk, Delft University of Technology, Dept. of Civil Engineering, Stevinweg 1, K5, 47, P.O. Box 5048, 2600 GA Delft, Netherlands.

4th International Congress of the International Association of Engineering Geology, New Delhi, India, 1-6 December 1982.

Information: Mr. Srivastava K.N., 47-48, Pragati House, Nehru Place, New Delhi 110019, India.

***International Conference on Chemistry and World Food Supplies - The New Frontiers (CHEMRAWN II)**, Manila, Philippines, Postponed from February 1982 to 6-10 December 1982. Organized by IUPAC and IRRI, with affiliate sponsoring by ISSS.

Information: Dr. Joyce C. Torio, CHEMRAWN II Coordinating Office, International Food Policy Research Institute, 1766 Massachusetts Avenue, N.W. Washington, DC 20036, USA.

1983

***2nd International Conference on Soil Erosion and Conservation**, Honolulu, Hawaii, USA, 16-22 January 1983.

Information: Dr. S. A. El-Swaify, Dept. of Agronomy and Soil Science, College of Tropical Agriculture and Human Resources, University of Hawaii, 3190 Maile Way, Honolulu, Hawaii 96822, USA.

Meeting on Biological Processes and Soil Fertility, Reading, England, 4-9 July 1983. (Joint meeting of ISSS Commissions III and IV).

Information: Dr. D. S. Jenkinson, Rothamsted Experimental Station, Harpenden, Herts., AL5 2JQ, U.K.

(Note: this is a revised announcement of the 1983 meeting previously called 'Interaction of Roots and Micro-organisms and the Cycling of Nitrogen', attributed to Commissions III and VI).

3rd International Symposium on microbial Ecology, East Lansing, Michigan, USA 7-12 August 1983.

Information: The Kellogg Center for Continuing Education, Michigan State University, East Lansing, Michigan 48824, USA.

Geomaterials: Rocks, Concretes, Soils, Evanston, Illinois, U.S.A., September 1983, IUTAM.

Information: Secretary-General IUTAM, Chalmers University of Technology, Fack, S-40220 Gothenburg 5, Sweden.

6th International Symposium on Environmental Biochemistry, Santa Fe, New Mexico, USA, 9-14 October 1983.

Information: Dr. D. E. Caldwell, Department of Biology, The University of New Mexico, Albuquerque, NM 87131, USA.

Centennial Commemoration of the Mount Krakatau Explosion, Indonesia.

Information: Committee on 100th Anniversary of Mt. Krakatau Explosion, Lipi, Jl. Tenku Chik Ditiro 43, Jakarta, Indonesia.

1984

12th International Congress on Irrigation and Drainage, Fort Collins, Denver Colorado, U.S.A.

Information: Secr. ICID, 48 Nyaya Marg. Chanakyapuri, New Delhi-110012, India.

The 10th International Congress of Agricultural Engineering, Budapest, Hungary.

Information: Gy. Szalai, CIGR Congress Coordinator, Comité National Hongrois de la CIGR, Kossuth Lajos tér 6-8. IV. 425, H-1372 Budapest, V., Hungary.

NEW PUBLICATIONS NOUVELLES PUBLICATIONS NEUE VERÖFFENTLICHUNGEN

Titles of new publications are listed here for information. Orders can not be handled by the ISSS Secretariat but should be placed through a bookstore or directly with the publishers. Nearly all publications mentioned can however be viewed at the seat of the Society, c/o the International Soil Museum (ISM) in Wageningen, the Netherlands.

Les titres de nouvelles publications sont mentionnés à titre d'information. Le Secrétariat de l'AISS ne peut pas se charger de commandes, celles-ci devant être adressées à une librairie ou directement aux éditeurs. Presque toutes les publications mentionnées peuvent toutefois être inspectées au siège de l'AISS, p/a the International Soil Museum (ISM) à Wageningen, Hollande.

Die Titel neuer Veröffentlichungen sind hier zur Information angeführt. Bitte richten Sie Ihre Bestellungen nicht an das IBG Sekretariat sondern an den Buchhandel oder direkt an die Verlage. Fast alle Veröffentlichungen sind jedoch zu besichtigen an der Stelle der iBG, p/a the International Soil Museum (ISM) in Wageningen, Holland.

Characterization of Soils in relation to their Classification and Management for Crop Production: Examples from some areas of the Humid Tropics. D. J. Greenland, editor. Clarendon Press: Oxford University Press, Oxford, 1981, 460 p. ISBN 0-19-854538-X.

The soil and climatic resources of the humid tropics are probably adequate to provide the food required by an increasing population if these resources can be developed on a sound basis. There are as yet few examples of sustained intensified food-crop production from the soils of the humid tropics. If the potential of these soils is to be realized it is essential that their physical and chemical properties should be properly assessed, so that the problems of providing plant nutrients from them economically, and avoiding their degradation by erosion, can be solved.

The work reported in this book represents a concerted effort to characterize a range of soils representative of the humid tropics of southern Nigeria and adjacent parts of West Africa. This characterization is in terms of production potential, and is such that the soils can be classified in terms of that potential.

For some of these soils much progress has been made in developing fertilization and management methods which enable high levels of production to be sustained over many years. The relationship between production and soil characteristics is discussed here, together with factors related to the classification of soils in different systems.

The relationship of the West African work to similar studies in South America is also demonstrated, and the importance of climate as well as soil characteristics in determining production potential is discussed.

Most papers have extensive lists of references. An appendix includes profile descriptions and analytical data of a large number of soils in this part of Nigeria.

Price: £ 35.00 in U.K.

Orders to: Oxford University Press, 116 High Street, Oxford OX1 4BZ, England.

Water and Related Land Resource Systems. Y. Haines and J. Kindler, editors. Pergamon Press, Oxford and New York, 1980, 524 p. ISBN 0-08-027307-6.

This large-format publication contains papers presented at a Symposium of the International Federation of Automatic Control, held in Cleveland, U.S.A. in May 1980. At the symposium many water and land resources problems and issues were discussed, as well as methodologies and procedures for respective solutions. Central to the Symposium's theme was the realization that these specific problems and complex issues transcend international state, and political boundaries; and that improvement of the transfer of knowledge in water and related land resources is paramount to the well being of mankind.

The ever-increasing competition for water and land resources in agriculture, urban development, mining, energy, etc. necessitates a more refined understanding of the prime factors and their interrelation.

The systems approach – through the use of modeling, simulation, and optimization methodologies – has, over the last decade markedly contributed to an appreciation of the distinct causal relationships between human activities and nature's response. This advance has led to better planning and management, but the systems approach has not yet commensurably reached its potential.

The following sessions papers are contained in this publication: multi-objective planning in water and land resources; acquisition and analysis of surface water quality data; hierarchical water resource planning and management models; environmental and ecological aspects, impact of energy development, and planning and management of water and land resources; acquisition and analysis of hydrologic data; ground-water and its conjunctive use with surface water; sedimentation and land management, predicting and forecasting models in water resources; evaluation and calibration problems in water resource modeling; and water and land use issues in urban areas.

This well-produced book has about 250 illustrations and 525 literature references.

Price: £ 50.00, or \$ 120.00

Orders to: Pergamon Press, Headington Hill Hall, Oxford OX3 0BW, England; or: Maxwell House, Fairview Park, Elmsford, NY 10523, U.S.A.

Proceedings of the Workshop on Land Evaluation for Forestry. ILRI Publication 28. P. Laban, editor. ILRI, Wageningen, 1981, 355 p. ISBN 90-70260-68-9.

Under the auspices of the International Union of Forestry Research Organizations (IUFRO) and the Working Group on Land Evaluation of the International Society of Soil Science (ISSS), an International Workshop on Land Evaluation for Forestry was held in Wageningen, The Netherlands in Nov. 1980.

The workshop was a result of the growing need among foresters to coordinate and integrate studies concerned with site and terrain classification and forest management planning, and the wish to incorporate forestry in a recently developed land evaluation approach, mainly oriented towards agriculture.

The present publication contains the opening speeches and welcome address, the conclusions, recommendations and actions (to be) taken. The 17 papers focus on the following subjects: dynamics of forest ecosystems, inventory techniques and land classification, site and terrain classification, concepts and procedures in land evaluation, land qualities and their relationships with the land use requirements of land utilization types, and important aspects of land evaluation and some practical applications in Europe and developing countries.

Price: Dfl. 43.00, postage included when prepaid.

Orders to: ILRI, P.O. Box 45, 6700 AA Wageningen, The Netherlands.

Physikalische Eigenschaften von Böden der Schweiz. Band 2. (Physical characteristics of Soils of Switzerland, Volume 2). Swiss Fed. Inst. of Technology, Zürich, 1981.

The first volume of this series on the soils of Switzerland was announced in Bulletin 57, page 42.

For the present volume 5 soils representative for large areas of the country were selected. Besides the description of the site and soil it contains a large number of physical and chemical data, a photograph of the landscape and a high quality large size colour photograph of the soil profile.

Price: SFr. 30 plus SFr. 4 postage

Orders to: Professur für Bodenphysik, ETH Zürich, Zürcherstrasse 111, CH-8903 Birmenshof, Switzerland.

Indian Soil Science Literature. A. Selected Bibliography 1966–1977. S. B. Varade, R. Subbaiah and J. V. Mande. Agricole Publishing Academy, New Delhi, 1981, 501 p.

This bibliography contains 3767 entries, including about 1000 dissertations, on soil science in India. Most of the publications appeared in India but also work published in foreign journals is included. The references are grouped into 12 major chapters.

This is timely publication in view of the 12th International Congress of Soil Science.

Price: Rs. 200 in India, \$ 40 elsewhere.

Orders to: Agricole Publishing Academy, D-76 Panchsheel Enclave, New Delhi 110 017, India.

Bibliography of Rice Soils, Rice Nutrition and its Fertilization, 1949–1979. Institute of Soil Science, Academia Sinica, Nanjing, 1980, 276 p.

This world-bibliography in English contains 4200 entries, subdivided into the following chapters: physical properties of rice soils; chemistry of rice soils; microorganisms and biochemical processes of rice soils; fertility of rice soils; genesis, morphology and classification of rice soils; nutrition and fertilization of rice; water and crop management; improvement of low-yield rice soils; and pollution of rice soils. There are frequent cross-references.

Orders to: Dept. of Information Service and Library, Institute of Soil Science, Academia Sinica, Nanjing, China.

Tropical Agricultural Hydrology, Watershed Management and Land Use. R. Lal and E. W. Russell, editors. John Wiley & Sons, Chichester, New York, 1981, 482 p. ISBN 0-471-27931-5.

There is a pressing need for works dealing with the hydrology of specific regions of the world. This unique volume, arising out of a Conference on the interactions of land use and catchment management, held at the International Institute of Tropical Agriculture in Ibadan, Nigeria, in November 1979, is devoted to hydrology in the tropics, and is written by experts who are familiar with tropical forest ecosystems.

Various topics are reviewed and discussed: changes in ecological parameters that affect crop production, such as hydrology, microclimate, water and energy balance, sediment transport, runoff and erosion, nutrient losses, water yield, etc.; hydrological aspect of watershed management and land use in the tropics concerning the productivity from fragile environments; problems associated with deforestation and the effects of a range of methods of deforestation. There are also studies of watershed modelling and a critical appraisal of available models and their application in the tropics. In addition, a review is made of a number of engineering structures for gully erosion control.

This comprehensive and authoritative work will be of interest to all those concerned with the global problems of water management and land use – hydrologists, ecologists, soil scientists, foresters, geographers, agriculturalists, climatologists, agricultural economists – as well as those involved more specifically in the research and planning of agriculture in the tropics.

This well-produced book contains many photographs and illustrative maps, tables and graphs.

Price: £ 26.50

Orders to: John Wiley & Sons, Baffins Lane, Chichester, Sussex P019 1UD, England; or: 605 Third Avenue, New York, NY 10016, U.S.A.

Submicroscopy of soils and weathered rocks. First Workshop of the International Working-Group on Submicroscopy of Undisturbed Soil Materials (IWGSUSM), 1980), Wageningen. E. B. A. Bisdom, editor. Pudoc, Wageningen, 320 p. ISBN 90-220-0777-4

The in-situ electron microscopic investigation of materials in thin section of soils and of undisturbed unimpregnated soil materials, has increased significantly during the last few years. As a result, new techniques have been developed and discussions on certain subjects have become more fundamental. The introduction of new techniques, viz. ion microscopy and laser microprobe mass analysis, have allowed not only the in-situ determination of trace elements, but also the quantification of these and other chemical elements.

The possibility to perform in-situ microchemical and ultramicrochemical analyses has increased the research possibilities of soil micromorphologists considerably. However, the integration of the new data, the methods to be used, and the costs which are involved, are of such a nature that international teamwork is necessary to solve basic problems in theoretical and applied soil micromorphology. Consequently, the 'International Working-Group on Submicroscopy of Undisturbed Soil Materials (IWGSUSM)' was started and this book is the result of the first workshop.

To allow some insight into the purpose and objectives of IWGSUSM, a special paper was prepared by Bisdom & Wells. It was also decided that the first book should give a number of papers with technical information and a review of modern submicroscopic research in the field of soil micromorphology. New preparation techniques for submicroscopic work were introduced, e.g. low temperature ashing to incinerate plastic in thin section, ion thinning, cytochemical staining techniques applied to organic matter in soils, and backscattered electron scanning image, which may be combined with Quantimet porosity investigation. The other papers give a variety of results using submicroscopy in various fields of soil micromorphology.

A glossary of abbreviations used in this book, viz. of terms for machines, parts of instruments, analysis techniques, and other subjects, has been included to assist the reader and to start the glossary-work of IWGSUSM. This glossary is in English and French, and so are the titles of papers, key words and summaries. The book is profusely illustrated with photographs, diagrams and tables.

Persons who are interested in the work of IWGSUSM, can write to: Dr. E. B. A. Bisdom, Department of Soil Micromorphology and Mineralogy, Netherlands Soil Survey Institute, P.O. Box 98, 6700 AB Wageningen, The Netherlands.

Price: Dfl. 80.00

Orders to: Pudoc, P.O. Box 4, 6700 AA Wageningen, The Netherlands.

Scanning Electron Microscopy and X-Ray Microanalysis. J. I. Goldstein, D. E. Newbury, P. Echlin, a.o.. Plenum Publishing Company, New York, 1981, 640 p. ISBN 0-306-40768-X.

Designed for the beginning student, this comprehensive volume serves as an introductory text in the field of scanning electron microscopy and X-ray microanalysis. It emphasizes the theories behind those instrument functions that can be controlled and those electron specimen phenomena encountered in studying the specimen. Extensive practical sample preparations are presented for biologists and physical scientists. Special emphasis is placed on X-ray spectral measurement and quantitative X-ray analysis.

Price: \$ 29.50 in U.S.A.; \$ 35.40 elsewhere

Orders to: Plenum Publ. Corp., 233 Spring Street, New York, NY 10013, U.S.A.
In Europe: Plenum Publ., 88/90 Middlesex Street, London E1 7EZ, England.

Report on the Agro-ecological Zones Project. Volume 4, Results for Southeast Asia. World Soil Resources Report 48/4. FAO, Rome, 1980, 39p., maps, figures, tables. ISBN 92-5-101009-9.

Projections reveal that to sustain the likely world population in the year 2000 an increase of 60 percent in agricultural production will be required. 'Is there sufficient land to do this?' becomes the overriding question, but little precise information exists on which to base a reliable answer. Previous appraisals of the global extents of arable lands, to support present and future human populations, vary from 3 to 7 thousand million hectares. Estimates of the populations these lands can support, vary from 7.5 to 40 thousand million.

These estimates however, do not take into account differences in production potential when it is calculated for different crops and different levels of inputs and technology. Such factors must be taken into account to arrive at realistic estimates of the agricultural production potential of the various lands of the world.

FAO initiated, in September 1976, a study of potential land use by agroecological zones to obtain a first approximation of the production potential of the world's land resources, and to provide the physical data base necessary for planning future agricultural development. Initially the project deals with rainfed production potential, at two levels of inputs, for eleven crops in developing countries.

Volume 1, Part A gives general and technical accounts of the overall methodology employed in the assessment. Part B reports results for Africa. Volume 2 contains results for Southwest Asia (see Bull. 59, p. 54). The present volume 4 gives results for Southeast Asia. It provides information on the rainfed agricultural production potential of eleven crops at two levels of inputs in the region.

Orders to: official country FAO sales representatives or, in case of difficulties, through Sales and Distribution Section, FAO, Via delle Terme di Caracalla, 00100 Rome, Italy.

The Thermodynamics of Soil Solutions. G. Sposito, Clarendon Press: Oxford University Press, Oxford, 1981, 233 p. ISBN 0-191857568-8.

Chemical thermodynamics is the theoretical structure on which the description of macroscopic assemblies of matter at equilibrium is based. This branch of physical chemistry was created 105 years ago by Josiah Willard Gibbs and was completed by the 1930s in the works of G. N. Lewis and E. A. Guggenheim. The fundamental principles of the discipline thus have long been established, and its scope as one of the five great subdivisions of physical science includes all of the chemical phenomena that material systems can exhibit in stable states.

Given the firm status of chemical thermodynamics, its application to describe chemical phenomena in soils would seem to be a straightforward exercise, but experience has proven different. An obvious reason for the difficulty that has been encountered is the preponderant complexity of soils. These multicomponent chemical systems comprise solid, liquid, and gaseous compounds that are continually modified by the actions of biological, hydrological, and geological agents. In particular, the labile aqueous phase in soil, the soil solution, is a dynamic, open, natural water system whose composition reflects especially the many reactions that can proceed simultaneously between an aqueous solution and a mixture of mineral and organic solids that itself varies both temporally and spatially.

This book is intended primarily as an introduction to the use of chemical thermodynamics for describing reactions in the soil solution. Therefore no account is given of phenomena in the gaseous and solid portions of soil unless they impinge directly on the properties of the liquid phase. This restriction is conducive to a clarity in presentation and relevant to the interests of most soil chemists. Although the discussion in this book is self-contained, it does require exposure to thermodynamics as taught in courses on physical chemistry that employ differential and integral calculus. Since most of the examples discussed relate to soil chemistry, a background of interest in that discipline will be of direct help in understanding the applications presented.

The first two chapters of this book review the fundamental concepts of chemical thermodynamics. Care is taken to show how these concepts relate to soils and the soil solution. The third, fourth, and fifth chapters take up the application of chemical thermodynamics to solubility, electrochemical (including redox), and ion-exchange phenomena as they occur in soils; they contain the bulk of thermodynamics that is of concern of soil chemists. The sixth chapter digresses to consider the molecular theory of cation exchange. This topic has been included because of the widespread use of model approaches, such as diffuse double layer theory, to interpret soil exchange phenomena. The seventh chapter presents the thermodynamic theory of water in soil from the perspective taken in soil physics (i.e., that the soil is a three-component, single-phase system).

Price: £ 24.00

Orders to: Oxford University Press, 416 High Street, Oxford OX1 4BZ, England.

Progress in Pesticide Biochemistry. Volume 1. D. H. Hutson and T. R. Roberts, editors. John Wiley & Sons, Chichester, New York, 1981, 346 p. ISBN 0-471-27920-X.

Primary publications on the biochemistry of pesticides are distributed widely throughout the scientific literature and the subject matter ranges from insect, plant, and soil biochemistry through to mammalian toxicology. This new series is one in which selected aspects will be reviewed and, where possible, be interrelated by experts in the various fields.

The following areas will be covered: mode of action, biotransformation in target species, biotransformation in non-target species (which may include soils, bacteria, plants, mammals, etc.), environmental effects, environmental chemistry, and biochemical toxicology in mammals.

In Volume 1 are of special importance to soil scientists articles on experimental approaches to studying the fate of pesticides in soils and the metabolism of the synthetic pyrethroids in plants and soils.

Price: £ 24.00

Orders to: John Wiley & Sons, Baffins Lane, Chichester, Sussex PO19 1UD, England; or: 605 Third Avenue, New York, NY 10016, U.S.A.

Agriculture in the Tropics, Second edition. Longman Tropical Agriculture Series, C. C. Webster and P. N. Wilson. Longman, London and New York, 1980, 640 p. ISBN 0-582-46814-0.

This a completely rewritten edition of the book that has become a standard work on the subject. It gives a general account of the basic factors affecting agriculture in the tropics and in particular the applications of recent research methods. In rewriting the text, of which the first edition appeared in 1966, the authors have borne in mind the increasing economic restraints imposed on small farmers by rising prices of equipment and fuel. Emphasis is placed on the increase of productivity at least cost to the farmer.

This well-illustrated textbook discusses the following main subjects: tropical climates, soils and vegetation; soil and water conservation, land clearing, drainage and tillage; farming systems; livestock and animal husbandry. It has a long list of references.

Price: £ 12.95, cased, in U.K.

Orders to: Longman Group, Longman House, Burnt Hill, Harlow, Essex CM20 2JE, England.

Soil Conservation. Problems and Prospects. R.P.C. Morgan, editor. John Wiley & Sons, Chichester, New York, 1981, 576 p. ISBN 0-471-27882-3.

Soil conservation remains vitally important to the future of world food production and, therefore, to man's survival. The International Conference on Soil Conservation, CONSERVATION 80, held at Silsoe in July 1980, provided a forum for the exchange of ideas and experiences between agricultural engineers, geomorphologists, pedologists, foresters, economists, and extension workers. It brought together contributions from those working in universities and research stations and those directly concerned with implementing soil conservation in the field. This volume is based on the Proceedings of the Conference.

The papers presented in this volume provide an up-to-date assessment of soil conservation measures, stressing the problems of applying these measures in practice and the possible solutions. Four themes are covered: the use of erosion risk assessments and land classification in soil conservation design; empirical studies of soil conservation measures, the inclusion of conservation practices in erosion models, and economic, social, and legal aspects of soil conservation.

The book will be of direct interest to those agriculturalists, agricultural engineers, soil scientists, agronomists, foresters, geographers, and hydrologists employed in soil erosion evaluation and soil conservation practice. It is also intended as a reference work at graduate or postgraduate level for the teachers and students of soil conservation.

The Silsoe meeting was a follow-up to the one held in 1978 on erosion assessment at the University of Ghent, Belgium. A volume based on the latter has also been published by Wiley entitled *Assessment of Erosion*, edited by M. De Boodt and D. Gabriels (see bulletin 59, p.53). A second closely related work is *Soil Erosion*, edited by M. J. Kirkby and R. P. C. Morgan, published by Wiley (see Bulletin 59, p. 51).
Price: £ 22.00

Orders to: John Wiley & Sons, Baffins Lane, Chichester, Sussex PO19 1UD, England; or: 605 Third Avenue, New York, NY 10016, U.S.A.

Proceedings of the Symposium on Peat Lands below Sea Level. H. de Bakker and M. W. van den Berg, editors. ILRI. Publication 30, ILRI, Wageningen, 1981, 300 p. ISBN 90-70-260700.

An International Symposium on Peat Lands below Sea Level took place at Wageningen, The Netherlands in August 1981. The Symposium was sponsored by Commission III of the International Peat Society and The Netherlands Soil Science Society.

The Proceedings assemble the papers as well as the reviews presented. The papers and reviews were presented in three sessions of three papers each. Subjects treated: geology of the Holocene; history of the reclamation of the western fenlands and the organization to keep them drained; soils and their geography; water management in the western Netherlands; drainage and behaviour of peat soils; urban use of peat soils; use of peat soils for grassland; farm management on peat soils; and use of peat soils for horticulture. In the reviews comparisons are made with coastal plain studies in several regions of the world.

It is hoped that the proceedings of this Symposium may contribute to the development of peat areas in other parts of the world and the researchers elsewhere may benefit from the age-long experience of the Dutch in 'making their landscape'.

Price: Dfl. 36.00, softbound.

Orders to: ILRI, P.O. Box 45, 6700 AA Wageningen, The Netherlands.

Soil Geography and Land Use. H. D. Foth and J. W. Schafer. John Wiley & Sons, New York and Chichester, 1981, 484 p. (paperback edition).

The hardcover soils textbook was announced in Bulletin 58, p.69. Now, a paperback edition has appeared in the Wiley International Edition.

This publication has a worldwide perspective, with major emphasis on soils of North America and secondary emphasis on soils of the other continents. Attention is given to the environmental conditions, soils and the agricultural potential. A 1:50 million soil map of the world has been used as basis information. The U.S. Soil Taxonomy system of soil classification is used throughout the text, the terms are correlated with those used in Canada. However, equivalents in other systems and the units of the legend of the FAO-Unesco Soil Map of the World are not given.

The book is well illustrated with graphs, tables and photographs.

Price: £ 8.30; or \$ 14.95

Orders to: John Wiley & Sons, Baffins Lane, Chichester, Sussex PO19 1UD, England, or: 605 Third Avenue, New York, NY 10016, U.S.A.

Soil Aggregate Stability Tests for the Geomorphologist. I. C. Grieve. Technical Bulletin 25, British Geomorphological Research Group, 1981, 28 p. ISBN 0-86094-039-X. Series: ISSN 0306-3380.

After an introduction on soil structure and its stability and the theory of aggregate stability determination, the author recommends a number of methods.

The Bulletin ends with an evaluation of results and an extensive bibliography for further reading.

Price: £ 1.25

Orders to: Geo Abstracts, University of East Anglia, Norwich NR4 7TJ, England.

Erosion and Sediment Transport Measurement/Mesure de l'érosion et du transport des sédiments. Int. Ass. of Hydrological Sciences, Publication No. 133. IAHS, 1981, 527 p.

This publication contains the proceedings of a symposium held in Florence, Italy, in June 1981. There is an increasing need for measurement programmes and resultant data in order to evaluate such problems as soil loss, land degradation, reservoir sedimentation and debris transport and deposition; to permit the design of effective hydraulic structures and channel management strategies; and to provide information on the transfer of material from the land surface of the globe to the oceans. The important role of sediment in nonpoint pollution, in the transport of nutrients and contaminants through terrestrial and aquatic ecosystems and in global geochemical cycles has given a new perspective to the study of erosion and sediment transport and new demands for data collection.

Fortunately, these intensifying needs have been paralleled by technological and methodological progress, and the past 20 years have seen a wide range of advances in instrumentation and measurement techniques and strategies for the study of erosion and sediment transport.

A number of these advances have been reviewed in recent international symposia, but there has not been an international meeting which has specifically addressed the measurement of erosion and sediment transport.

The Florence Symposium reviewed recent developments in these fields and defined outstanding problems and research needs. More than 50 papers are included in the present publication and they report developments and experience with a wide spectrum of measurement techniques in a great variety of environments which range from wet tropical areas to desert regions. The following subjects are dealt with: measurement of sediment transport; measurement of erosion; the last subject being subdivided into papers on the measurement of rainfall erosivity and splash erosion, rainfall simulators, erosion plot studies and field measurement of erosion.

Papers are in English and carry an abstract in French.

Price: \$ 54.00; or about FF 325

Orders to: Office of the Treasurer IAHS, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.; or: IUGG Publication Office, 39 ter Rue Gay Lussac, 75005 Paris, France.

Conservacion de Suelos. F. Suárez de Castro. Instituto Interamericano de Ciencias Agrícolas, San José, 1980, 315 p.

This is a textbook on principles and practices of the conservation of soils. After an introduction on the genesis and characteristics of soils and chapters on soil erosion, the main part of the book is concerned with practical soil conservation methods. This includes agronomical as well as engineering methods, e.g. the building of dams, terraces, and canals.

It is followed by a chapter on some special types of erosion control, such as the use of fast growing plants, building of dikes, jetties in rivers. The last chapter outlines a national soil conservation programme. Orders to: IICA, Apartado Postal 55, 2200 Coronado, San José, Costa Rica.

Proceedings of the Bangkok Symposium on Acid Sulphate Soils. H. Dost and N. van Breemen, editors. ILRI Publication 31. ILRI, Wageningen, 1981, 454 p. ISBN 90-70-260719.

With population growth and diminishing arable land reserves, population pressure on tropical coastal lowlands is increasing. The coastal swamps are generally well suited for reclamation for wetland rice cultivation, but often hide areas that with normal drainage abruptly develop into acid sulphate soils. Without special drainage and flooding provisions in these areas, recurrent acidification is apt to persist for years and acidulated drainage water may affect surrounding areas. Technological methods to recognize potential acid sulphate soils and to keep their acidification within bound are being developed. Their application can already prevent or alleviate problems in many agro-ecological situations. Effective application is hampered however because publications dealing with these methods are not readily available. The information is dispersed in unpublished reports and a large variety of periodicals. To pool the up-to-date experience and information, the Second International Symposium on Acid Sulphate Soils was held in Bangkok in 1981.

This publication represents the proceedings of the Symposium. Besides general resolutions and specific technical conclusions and recommendations, it contains 25 selected articles on the following subjects: direction of further research on acid sulphate soils; social and economic aspects of the reclamation of acid sulphate soils; factors influencing the formation of potential acidity in tidal swamps; quantitative models to predict the rate and severity of acid sulphate development; soils survey of tidal sulphidic soils in the tropics; problems of classifying soils with sulphidic horizons; acid sulphate soils of the mangrove areas of Senegal and Gambia; several papers dealing with the characteristics, fertility status and the effects on soil ameliorants on productivity of acid sulphate soils of Senegal, Thailand, Malaysia, Vietnam and The Philippines; traditional empirical solutions for acid sulphate soil problems in rice cultivation; varietal reactions of rice to toxicity phenomena; effect of water management on field performance of oil palms on acid sulphate soils in Malaysia; water-soil-rice plant interactions; problems met in reclaiming tidal lowlands in Indonesia.

A chapter with full-length translations or abstracts in French has been added.

Price: Dfl. 54.00, softbound.

Orders to: ILRI, P.O. Box 45, 6700 AA Wageningen, The Netherlands.

Landschaftstechnik. J. Barner. Ferdinand Enke Verlag, Stuttgart, 1981, 180 S., 38 Abb., 7 Tab., Kartoniert. ISBN 3-432-91581-0.

Das Aufgabengebiet der Landschaftstechnik besteht darin, (bereits eingetretene) Landschaftsschäden mit überwiegend ökotechnischen Mitteln zu beseitigen oder solchen vorzubeugen. Das Ergebnis ihrer Bemühungen ist eine nachhaltige und pflegliche Behandlung aller entscheidenden ökologischen Faktoren, so vor allem des Wassers, des Bodens und der Luft, sowie der heimischen Tier- und Pflanzenwelt. Dabei erstrecken sich ihre Bemühungen gleichermaßen auf das Areal der Stadt-, Wald- und offenen Landschaft, um nicht nur die dortigen ökologischen, sondern auch die sozialen und wirtschaftlichen Verhältnisse zu verbessern. Die Landschaftstechnik besteht somit in einer ausgeprägten Gestaltungs- und Ordnungsaufgabe, die es teils mit gefährdeten, aber auch mit bereits zerstörten Landschaftsteilen zu tun hat.

Inhaltsübersicht: die landschaftstechnische Behandlung der Stadtlandschaft; die landschaftstechnische Behandlung der offenen Landschaft; die landschaftstechnische Behandlung der Waldlandschaft; die landschaftstechnische Behandlung naturgeschützter Gebiete; das Instrumentarium der Landschaftstechnik; und *Grundlinien einer Landschaftsplanung zur Durchführung von landschaftstechnischen Projekten.*

Preis: DM 34.00

Bestellungen an: F. Enke Verlag, Postfach 1304, D-7000 Stuttgart 1, Bundesrepublik Deutschland.

Perception of Desertification. R. L. Heathcote, editor. The United Nations University, 1980, 136 p. ISBN 92-808-0190-2. UNU publ. NRTS-10/UNUP-190.

This report was published within the framework of the United Nations University's Programme on the Use and Management of Natural Resources.

The first chapter provides the context for these studies within the broad research activity in environmental perception. The final chapter attempts a general summary of the findings in four study areas in Sri Lanka, the U.S.A. and Australia, and suggests specific lessons which might be borne in mind by decision makers attempting to mitigate the impact of desertification in the study areas as well as lessons which have a more general relevance.

It is concluded that desertification will continue to be a problem in the four study areas. This seems to be the result of a complex interplay of many factors, which might be summarized as the interrelationships between physical and the human environment.

An interesting publication on this aspect of soil degradation, not only for the regions studied, but also for other dry areas in Africa, the Near and Middle East.

Price: about \$ 20.00

Orders to: Europe: Bowker Publishing Company, Erasmus House Epping, Essex CM16 4BU, England; U.S.A.: UNIPUB, 345 Park Avenue South, New York, NY 10010, U.S.A.; or: The United Nations University, Toho Seimei Building, 15-1 Shibuya 2-chome, Shibuya-ku, Tokyo 150, Japan.

Stability of Spruce Forest Ecosystems. E. Klimo, editor. Institute of Forest Ecology, University of Agriculture, Brno, Czechoslovakia, 1980, 517 p., mimeographed.

This publication contains the proceedings of an international symposium, held in Brno, Czechoslovakia in Oct./Nov. 1979. It was sponsored by Unesco's Man and Biosphere National Committee and IUFRO.

In 44 papers, with one exception all in English, scientists from Europe, Canada and Afghanistan present accounts on the following aspects: the theory of ecosystem stability and its application to spruce-forest ecosystems, habitat relationships and their role in the stability of the spruce-forest ecosystem, the aspects of production and protection, including management.

Price: free of charge as long as the small stock lasts

Requests to: Doc. Ing. E. Klimo, CSc., Institute of Forest Ecology, Faculty of Forestry, University of Agriculture, Zemedelska 3, 66266 Brno, Czechoslovakia.

Microscopes and their Uses. C. Marmasse. Gordon and Breach, New York, London Paris, 1980, 344 p. ISBN 0-677-05510-2.

This book is intended for the practical microscopist who is already familiar with elementary microscopy. The author states that many investigators do not fully employ their skilfully designed instruments and he stresses the fact that diligent manipulation and a sound knowledge of the capabilities and limitations of the optical system will take the microscopist a long way.

The author discusses in a physical context the advantages and disadvantages of the optical components and gives the pros and cons of various methods in brightfield, darkfield, fluorescence, polarizing, phase contrast and ultramicroscopy. There is a section on photomicrographic equipment and techniques and a final chapter deals with micrometric devices, accessories and procedures.

This book is recommended, especially to those investigators who resort more and more to modern but extremely expensive submicroscopic instruments without first having tried to obtain the utmost of their relatively cheap light microscopes.

Price: \$ 20.00

Orders to: Gordon and Breach, 1 Park Avenue, New York, NY 10016, U.S.A.; 42 William IV Street, London WC2N 4DE, England; or: 7-9 Rue Emile Dubois, 75014 Paris, France.

Annual Cropping Systems in The Tropics. M. J. T. Norman. The University Presses of Florida, Gainesville, 1980, 276 p. ISBN 0-8130-0632-5.

This introductory textbook for university students brings together the basic biological and physical principles underlying the pattern and operations of tropical farming systems. It is restricted to annual cropping systems, mainly in Africa and Asia.

After introductory chapters on general hydrological, energetic, biochemical and socio-economic aspects of farming, attention is given to these aspects in a number of cultivation and rainfed and irrigation cropping systems. From shifting cultivation to semi-intensive and intensive systems. The last chapters deal with the role of livestock in the cropping systems and with the objectives, components and the evaluation and transfer of farming systems research. Each chapter has a number of references for further reading.

Price: \$ 20.00

Orders to: The University Presses of Florida, 15 Northwest 15th Street, Gainesville, FL 32603, U.S.A.

National Soils Conference 1980, Review Papers, Australian Society of Soil Science. T. S. Abbott, C. A. Hawkins and P. G. E. Searle, editors. ASSS, Glen Osmond, 1981, 105 p. ISBN. 0-9596414-2-4.

These review papers were presented at the National Soil Conference 1980, held in Sydney in May 1980, the first of its kind to be run solely as a Society venture.

The papers are in the field of pedology, soil/plant relations, soil management, land use and soil microbiology. These keynote addresses were the subject reviews around which the technical side of the Conference was arranged. The current position in these fields is outlined and future research is indicated. This publication also contains interesting papers on the training and employment of soil scientists in the future in Australia and the place of soils and soil science in the past and future of this continent.

Price: AS 5 post-paid within Australia, A\$ 6 post-paid surface mail elsewhere.

Orders to: Dr. A. M. Alston, Australian Society of Soil Science, Department of Soil Science, Waite Agricultural Research Institute, Glen Osmond, SA 5064, Australia.

Bibliography on Mangrove Research 1600-1975. B. Rolet. Unesco, Paris, 1981, 479 p. ISBN 92-3-101819-1.

Mangroves, the evergreen forests found between the land and sea in the intertropical zones and around coastal lagoons are the simplest and best defined ecosystems among tropical forest.

This bibliography bears witness to the mounting interest in mangroves, also among soil scientists. It should promote further research, a better management of the mangroves and an increased understanding of their biological role in food chains and in the reproduction and protection of floral and faunal species. After 1975 all relevant documentation is included in the data base of ASFIF (Aquatic Sciences and Fisheries Information System). The bibliography is also to be published in Spanish.

Price: FF 180

Orders to: Unesco National Distributors around the world.

Clay Minerals. Ernő Nemečz. Akadémiai Kiadó, Budapest, 1981, 547 p. ISBN 963-05-1989-5.

This book is concerned with three main topics: the kinds of clay minerals, identification of the various kinds and their occurrence in nature. In the first part a detailed treatment is given of the crystal structure and chemistry of clay minerals, listing their chemical composition and diffraction data.

The second part facilitates work in the field of clay minerals by describing them with an elaborated system of identification including X-ray analysis, thermal analysis, electron microscopy, chemical analysis, ion exchange tests and infrared spectroscopy.

The third part discusses the formation and transformation of clay minerals both synthetically and under natural conditions (hydrothermally, in cool waters, in soils, etc.). Also their role in various geological processes is treated.

Price: \$ 48.00

Orders to: Kultura, P.O.B. 149, H-1389 Budapest, Hungary.

Chemistry in the Soil Environment. American Society of Agronomy Special Publication Number 40. ASA and SSSA, Madison, 1981, 259 p. ISBN 0-89118-065-6.

Managing chemicals in the environment is a major endeavor of man. The ever increasing number of complexity of synthetic chemicals as well as management of natural chemicals has been of tremendous benefit to humans. Efficient and high-yielding crop production depends upon proper use of fertilizers, pesticides and other chemicals. However, out of place, chemicals can be unsafe.

It is imperative that in the years ahead, more effective means of using chemicals must be developed for food and fiber production. At the same time, these chemicals must be managed in the soil so as to eliminate or minimize health risks.

This publication emphasizes the chemistry of elements accumulated by growing plants, their movement, sorption and equilibria in soils, and the sources and types of charges driving these varied phenomena.

Nineteen authors integrated the basic theories and concepts of soil chemistry as they relate to soil properties and soil-plant-environment interrelationships. This book with 13 contributions will serve as an excellent reference for years to come.

Price: \$ 10.00. Advance payment and \$ 0.75 per book required on orders outside the U.S.A.

Orders to: ASA, 677 South Segoe Road, Madison, WI 53711, U.S.A.

Water Potential Relations in Soil Microbiology. Soil Science Society of America Special Publication Number 9. SSSA, Madison, 1981, 151 p. ISBN 0-89118-767-7.

Soil microorganisms greatly affect a wide array of soil properties such as water holding characteristics, cation exchange capacity, soil tilth and soil organic matter. But how do all these different soil microorganisms respond to the soil environment?

Soil microbiology and the effect of soil microbiological inhibitors on the soil environment are quite new. In this publication is shown how soil water influences microbial growth. This publication presents the ideas and observations of ten scientists on the concept and use of water potential applied to soil microbiology and biochemistry, plant pathology and the microbial ecology of soils. Specifically, the papers cover the theory and measurement of water potential; the effect of water potential on the growth, activity and survival of microorganisms, including plant pathogens; and water potential as a selective factor in the microbial ecology of soils.

This publication also provides the clarity needed when referring to water potential and other soil moisture constants. Although the concept of water potential has been widely accepted, many soil scientists continue to use such soil moisture constants as saturation capacity, water-holding capacity, field capacity and permanent wilting point. In studies where water is a variable, such parameters have no value in predicting and interpreting the response of microorganisms in soils. However, acceptance of and reference to water potential would allow for valid comparisons of water obtained from different investigations involving different soils and experimental conditions.

The publication provides a complete review of the concept of water potential and its importance in studying the water relations of soil microorganisms. The publication contains 5 papers and is written especially for researchers, teachers and students.

Price: \$ 6.25. Advance payment and \$ 0.75 per book required on orders outside the U.S.A.

Orders to: SSSA, 677 South Segoe Road, Madison, WI 53711, U.S.A.

Terrestrial Nitrogen Cycles. Processes, Ecosystem Strategies and Management Impacts. Ecological Bulletin 33. F. E. Clark and T. Rosswall, editors. Swedish Natural Science Research Council (NFR), Stockholm, 1981, 709 p. ISBN 91-546-0290-4.

This book is a collection of the proceedings from the international workshop arranged in September 1979 by the SCOPE/UNEP International Nitrogen Unit in collaboration with the Commission for Research on Natural Resources, the Swedish Council for Planning and Coordination of Research. There is a great need for better scientific understanding to solve various urgent problems concerning the possibility of raising the biological production of food, fodder, fiber and fuel from increasingly exploited land areas with a minimum of adverse environmental effects.

The publication with its broad coverage of highly important scientific area, is useful as a summary of present knowledge, and in giving pure and applied scientists better insight into each other's problems. With its 700 pages, it is a comprehensive presentation of today's knowledge of the biogeochemical nitrogen cycle. After four introductory papers, eighteen papers are on processes, eight on ecosystem strategies, and nine on management impacts. Most papers have extensive lists of references. In the conclusions of the workshop the problems, present knowledge and future research needs on terrestrial nitrogen cycles are outlined.

Price: SwKr. 250 (about US\$ 55, £ 25), including airmail postage.

Orders to: The Editorial Service NFR, Box 23136, S-104 35 Stockholm, Sweden.

Effects of Heavy Metal Pollution on Plants. N. W. Lepp, editor. Vol. 1, Effects Of Trace Metals On Plant Function. Vol. 2, Metals in The Environment. Applied Science Publishers, London and New Jersey, 1981. Vol. 1, 364 p., ISBN 0-85334-959-2. Vol. 2, 265 p., ISBN 0-85334-923-1.

This is the first publication in the new Pollution Monitoring Series, advisory editor K. Mellanby, published by Applied Science Publishers. Trace elements occur as natural constituents of the earth's crust and are ever present constituents of soils, natural waters and living matter. The biological significance of these elements has gradually been uncovered and the resultant picture is one of ever increasing complexity.

The present first volume of this comprehensive work relating to all aspects of plant/trace metal interactions, provides an overview of current research on the effects of specific trace elements on plant function. Attention is also given to arsenic, selenium and antimony. The occurrence of trace elements in soils and parent rocks has also been dealt with.

It is shown that elements such as copper and zinc, long known as essential to life, are now being joined in this category by nickel. The alarming mobility of cadmium in soils and crops is highlighted, but the other toxic element, lead, is demonstrated to have a much lesser potential impact on crop production.

Volume 2 is concerned with more integrated accounts of the potential impact of these elements on natural and man-made ecosystems, together with consideration of sources of trace metals and their interactions with soils.

Each volume contains 8 contributions with many tables, illustrations and extensive lists of references.

Prices: Volume 1 £ 26.00; Volume 2 £ 21.00

Orders to: Applied Science Publishers, 22 Ripplestone Commercial Estate, Ripple Road, Barking, Essex, England IG11 0SA.

SOLS. Département des Sols, Institut National Agronomique Paris-Grignon. Publication non-périodique.

Le Département des Sols de L'INA, Paris-Grignon va assurer des publications dont le nom est 'Sols'. Ces fascicules de 40 à 80 pages porteront sur plusieurs sujets tels que résumés de thèses ou synthèses, analyses et critiques de divers sujets de bibliographie, et comptes rendus de colloques et séminaires.

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Pour tous renseignements, adressez-vous à Dr. M-C. Girard, Institut National Agronomique Paris-Grignon, 78850 Thiverval-Grignon, France.

Soil and Water Resources: Research Priorities for the Nation. W. E. Larson, L. M. Walsh, B. A. Stewart and D. H. Boelter, editors. Soil Science Society of America, Madison, 1981, 14 + 229 p. ISBN 0-89118-768-5.

Out of concern for America's dwindling resources which are needed to meet rapidly growing worldwide food needs, 100 of the nation's leading soil and water specialists recently established the six most important research priorities for managing and preserving our soil and water resources.

The goal of the Soil and Water Resources Workshop, held in Madison, in February 1981, was to determine if and how the productivity of America's soil and water resources can be sustained into the next century. The priorities set included sustaining soil productivity, developing conservation technology, managing water in stressed environments, improving and implementing conservation policy, protecting water quality, and assessing soil and water resources.

As in many other countries, it is stated that Americans take soil and water for granted. However, not realized by many people, the demands for food and fibre rose and will further rise dramatically. It is mentioned that in the heart of the U.S. Corn Belt, the average annual soil loss was put at two bushels of soil for each bushel of corn produced. Also, in some areas the demand for water cannot continue to be met. In fact, prime agricultural land is drying up every day and going out of production since the water resources are not available.

The report summarizes: 'We must readdress the role of agricultural research in relation to long term national need, particularly research concerned with the care and maintenance of the soil and water resources which are responsible for much of our agricultural productivity. Unless we make a commitment to basic research and restock our storehouse of fundamental knowledge, meeting the soil and water research objectives identified at this workshop will be impossible'.

Price: \$ 12.00. Advance payment and \$ 0.75 per book required on orders outside the U.S.A.

Orders to: Soil Science Society of America, 677 South Segoe Road, Madison, Wisconsin 53711, U.S.A.

Advances in Food-Producing Systems for Arid and Semiarid Lands. Parts A and B. J. T. Manassah and E. J. Briskey, editors. Academic Press, New York and London, 1981, 1274 p. Part A: ISBN 0-12-467301-5 (cloth), Part B: ISBN 0-12-467302-3 (cloth).

These volumes have been assembled from the proceedings of the symposium on Advances in Food-Producing Systems for Arid and Semiarid Lands, held in Kuwait in April 1980. This symposium was prompted by the enormous future need for food in these regions, constituting 36% of the total land area of the earth. The different sessions of the symposium concentrate on the following topics: define the needs, the role of research and the potential for overcoming food deficits in arid and semiarid lands; the potential role of biotechnology; the improvement of water management; productivity of the vast rangelands; aquaculture systems; food storage and food processing. All eight chapters, with 45 papers, are followed by a summary and the gist of the discussions held. In a brief summary of all presentations in the symposium a series of action points are given. It is followed by an enumeration of the 'elements of a master plan' for food producing systems in arid and semiarid lands. It is mainly based upon integrated assessments of natural resources, economic conditions, identification of products which could be produced, assessment of markets, infrastructure, etc.

This very interesting publication ends with a case study on Kuwait's potentially developable industries. *Prices:* Part A: \$ 55.00 cloth. Part B: \$ 55.00, cloth. Also available in paperback edition.

Orders to: Academic Press, 111 Fith Avenue, New York, NY 10003, U.S.A.; or Academic Press, 24/28 Oval Road, London NW1 7DX, England.

Traité de Pédologie Agricole. Tome 2, Les Facteurs de la Pédogénèse. G. Gaucher, Editions G. Lelotte, Dison, 1981, 730 p.

Faisant suite au tome I, paru en 1967 auprès Dumod Editeurs à Paris, qui présentait le sol comme une entité pédologique et étudiait ses constituants et ses propriétés, ce tome II procède à un examen complet des causes qui déclenchent, entretiennent et modulent les processus de formation des sols, et qui sont considérées comme les 'facteurs' de la pédogénèse. Les données concernant leur identification et la compréhension de leur rôle constituent en effet le 'capital de connaissances scientifiques' qui est indispensable à l'esprit du pédologue pour analyser les phénomènes de la genèse des sols et découvrir leurs mécanismes.

Ici, chacun de ces facteurs est étudié sous ses aspects fondamentaux en tenant compte des apports récents de la science dont il relève, puis spécialement sous l'angle de ses interventions dans la formation des sols et le développement de leurs propriétés. L'auteur s'est ainsi particulièrement attaché à associer dans un texte clair, et facilement accessible aux débutants, les données fondamentales et les enseignements de la science du sol, et aussi leurs prolongements agronomiques.

Price: BFr. 1550.

Commandes à: Editions G. Lelotte, B-4820 Dison, Belgique.

Soil Biochemistry, Volume 5. E. A. Paul and J. N. Ladd, editors. Marcel Dekker, New York and Basel, 1981, 504 p. ISBN 0-8247-1131-9.

The selection of topics for review in Soil Biochemistry, Volume 5, continues a trend established in earlier volumes in this series. The editors considered a wide range of subjects, including the biochemical turnover of specific elements and organic components in soil; the properties and function of soil enzymes; and the structure, distribution, and pathways of metabolism of organic compounds, occurring either naturally in soil or introduced as a result of human activities. Topics exemplifying each of these aspects of soil biochemistry are reviewed in this volume. Their selection was justified either because relevant established information was scattered and no recent comprehensive overview of the subject was available, or because new discoveries were accruing rapidly from investigations, which often had been initiated after consideration of environmental impact issues, or because recent advances in methodology have permitted new and exciting approaches to be made to obtain a yet more detailed understanding of factors influencing biochemical activities in the soil microenvironment.

This fifth volume in the Books in Soils and Environment Series features in-depth discussions of new methodologies for measuring soil biomass and for establishing in situ the location of live and dead organisms and their products, including intra- and extracellular enzymes. This information is of particular concern to workers who are involved in quantifying systems. The chapters on nitrogen fixation, urea transformation, and denitrification consolidate new advance in these areas that are of special interest to soil scientists, microbiologists, workers in aquatic research, and environmentalists.

Price: Swiss Fr. 175.00

Orders to: Marcel Dekker, Inc., 270 Madison Avenue, New York, NY 10016, U.S.A.

Land Resource Evaluation. J. Lee and L. van der Plas, editors. Commission of the European Communities, publ. EUR. 6875 EN, 1980, 145 p. ISBN 92-825-2013-7.

The expert group on land use and rural resources was established following a request of the Standing Committee on Agricultural Research (CPRA) to prepare an inventory of land use and rural resource problems in the European Community.

4388-8,6 The present publication contains the papers presented at a seminar, held at Wexford, Ireland, in November 1978. It deals with major land use problems, proposed steps to overcome these problems and present and proposed research in this field, as well as research fit for common action under the ECC 'Land Use and Rural Resources' study group. This inventory of land resource evaluation in the countries of the Community contains 13 papers, a discussion and a list of proposals arising from the seminar.

Price: BFr20. 280, DM 17,60, \$ 10.

Orders to: Sales Offices for Publications of the European Communities.

Enquiries: Office for Official Publications of the European Communities, B.P. 1003, Luxembourg, Lux.

Agronomic-Economic Research on Soils of the Tropics, 1978-1979 Report. Soil Science Dept., North Carolina State University, Raleigh, 1980, 284 p.

This seventh report on the Tropical Soils Research Program carried out by the Soil Science Department of North Carolina State University, Raleigh, contains the results of agronomic-economic research in the cerrado of Brazil, the Amazon jungle of Peru and extrapolation activities, both to local small farmers and to other areas in the region, e.g. the Bolivian savannas. Furthermore, attention is given to results of intercropping and the economic interpretation of agronomic data. The overall objectives of the Program are to develop economically-sound soil-crop management systems for tropical rain forests and acid savannas, and to validate these systems on small farms presently under shifting cultivation and to refine means to extrapolate results to other areas of the world with similar agronomic and socio-economic conditions.

Price: free of charge.

Requests to: Tropical Soils Research Program, Soil Science Dept., NCSU, Raleigh NC 27650, U.S.A.

Transferring Technology for Small-Scale Farming. ASA Special Publication Number 41. N. R. Usherwood, editor. American Society of Agronomy, Madison, 1981, 132 p. ISBN 0-89118-066-4.

This publication contains the proceedings of a symposium of the American Society of Agronomy in Chicago, December 1978.

Cultivators with limited resources on small land holdings are the mainstay of the food supply for billions of people in spite of the successful development of extensive commercial farms in many parts of the world. *This situation is likely to continue for decades – perhaps centuries.*

Much of the world's land in relatively intensive food production is in small farms. The potential for increased food production, therefore, would be tremendous if yield increments could be added on each hectare. But the millions of farmers cultivating these small fields present a monumental technology transfer problem.

For the most part, these food producers are uneducated or illiterate, nevertheless, they are intelligent. They farm to maximize utility of what they produce or to maximize profit, depending upon the social system and infrastructure in which they live.

How does a program intended to increase production through adoption of new technology reach half a billion farmers like these? Or fifty million? What technology can they use? Can the resources be delivered? What constrains technology adoption? The symposium program upon which this special report is based was prompted by such questions and has provided some answers. The authors of the 9 papers are well acquainted with small-scale farming in both the tropical and temperate zones.

Price: \$ 5.50. Advance payment and \$ 0.75 per book required on orders outside the U.S.A.

Orders to: American Society of Agronomy, 677 South Segoe Road, Madison, Wisconsin 53711, U.S.A.

Soil Fungi and Soil Fertility. An introduction to soil mycology. 2nd Edition. S. D. Garrett. Pergamon Press, Oxford, New York, 1981, 150 p. ISBN 0-08-025506-X Flexicover; 0-08-025507-8 Hardcover.

The first part of the book explains the relevance of microbial activity to the maintenance of soil fertility through a discussion of soil physics, chemistry and ecology. The second part is devoted to a discussion of the problems currently studied by soil mycologists in their search for methods of ecological control of pathogenic root-infecting fungi and for ways of promoting the growth of mycorrhizal fungi in infertile soil.

The second edition has been extensively re-written to take account of the many advances that have taken place in soil mycology since the publication of the first edition in 1963.

This publication contains the following chapters: soils as a habitat, living inhabitants of the soil, form and function in fungi, genetics and classification of fungi, studying the soil fungus flora, competitive saprophytic colonization of substrates by soil fungi, saprophytic survival by soil fungi on colonized substrates, and root-infecting fungi.

Price: \$ 9.50 (£ 4.00) flexicover; \$ 19.00 (£ 7.90) hardcover.

Orders to: Pergamon Press, Headington Hill Hall, Oxford OX3 0BW, England; or: Pergamon Press, Maxwell House, Fairview Park, Elmsford, NY 10523, U.S.A.

Lateritization Processes. M. K. Roy Chowdhury, B. P. Radhakrishna, R. Vaidyanadhan, P. K. Banerjee and K. Ranganathan, editors. A. A. Balkema, Rotterdam, 1981, 450 p. ISBN 90-6191-202-4.

Ever since Buchanan (1807) coined the term 'laterite' for a certain kind of intensely weathered material in S. India, it has been the object of much research by geologists, soil scientists, mining engineers and others. It is well-known that many inconsistencies and confusion exist in the literature about laterite and lateritization.

Project 129 of the International Geological Correlation Programme dealing with Lateritization Processes started in 1977 and will terminate in 1983.

The present book contains 51 of the 55 papers presented at an international seminar held in Trivandrum, India in December 1979. They review the work on various aspects of lateritization the world over, discuss the problems and indicate further programmes of investigations and research activities. This volume provides a very useful reference to obtain a knowledge of the present status of the work, prevailing concepts, results of current research activities and scope of future investigations on various aspects of laterite studies.

The following major topics are discussed: geomorphic and genetic aspects; distribution in space and time, and global tectonics or paleoenvironmental controls; geochemistry; geochemical, geophysical and other exploration techniques for assessing mineral deposits associated with lateritic material; sampling and analysis of laterites; applied aspects of laterite studies in relation to agriculture, forestry, geohydrology and geotechniques.

This publication presents in a single volume the major scientific contributions on the present state of knowledge, the research activities and the scope of future investigations and it will become a reference work for geologists, mineralogists, soil scientists, mining engineers, and others dealing with laterites for years to come.

Price: Dfl. 125.00, \$ 62.50, or £ 25.00; including postage if prepaid.

Orders to: A. A. Balkema Publishers, P. O. Box 1675, Rotterdam, Netherlands; or: 99 Main Street, Salem, NH. 03079, U.S.A.

Agricultural Compendium for Rural Development in the Tropics and Subtropics. Produced and edited by ILACO, Arnhem. Elsevier, Amsterdam, Oxford, New York, 1981, 739 p. ISBN 0-444-41952-7.

This practical guide, written by a large number of specialists with fieldwork experience, is a valuable aid for all those involved in rural development activities in tropical and subtropical regions. It is a unique compilation of all the important aspects of rural and agricultural development, presenting a wealth of information from a variety of related disciplines.

Great care has been taken to give the user easy access to the information provided in this Compendium. A systematic layout, extensive list of contents and a detailed subject index make it possible to find the information quickly and easily. The many tables, formulas, figures and graphs will be particularly useful when making basic calculations. This handsome book has the following chapters: climatology, soil and land classification, geodesy, water control, land improvements, agriculture, animal production and fisheries, farm economics, economic and financial appraisal of projects, sociology, and a chapter with tables and supporting data. All chapters have a list of references for further reading.

The book is well produced and sturdy, allowing an intensive use by fieldworkers as well as by administrators, advisers and others involved in the planning process of rural areas. It is stated that the reader is presumed to have completed a college or university degree.

For the large amount of information given, the price is reasonable.

Price: Dfl. 100.00 (about \$ 42.00)

Orders to: Elsevier Scientific Publishing Company, P.O. Box 211, 1000 AE Amsterdam, The Netherlands; Elsevier North-Holland, 52 Vanderbilt Avenue, New York, NY 10017, U.S.A.; or: D.A. Book Depot, 11-13 Station Street, Mitcham, Vic. 3132, Australia.

Irrigation, Challenges of the 80's. Proceedings of the American Society of Agricultural Engineers Second National Irrigation Symposium, October 1980. ASAE, St. Joseph, 1981, 252 p. ISBN 0-916150-33-X.

The publication contains the papers presented at the symposium. The objectives of the conference were a discussion of irrigation advances, an opportunity to evaluate problems and challenges for irrigation in the 1980's and projections for the decade of the 1980's. In all 26 papers are included in the following subjects: irrigation development (3 papers), impact of irrigation development (4 papers), advances in irrigation systems (6 papers), advances in irrigation system management (9 papers), and future of irrigation (4 papers). Although most of the papers deal with conditions in the U.S., many contributions are also of interest to scientists of other continents where irrigation is important.

Price: \$ 25.00 postage paid, prepayment required.

Orders to: ASAE, P.O. Box 410, St. Joseph, MI 49085, U.S.A.

Crop Production with Conservation in the 80's. Proceedings of the American Society of Agricultural Engineers Conference on Crop Production with Conservation in the 80's, December 1980. ASAE, St. Joseph, 1981, 288p. ISBN 0-916150-34-8.

Recognizing the importance of soil conservation and the continuing need to reduce soil erosion losses, conference speakers addressed several critical areas that will prevent the loss of soil productivity. The 29 papers covered: needs for production and conservation, tillage systems and equipment, conservation tillage, pest control with conservation tillage, soil conservation practices, and energy conservation. Since soil conservation is of worldwide importance, this publication is also of interest to agriculturalists outside the U.S.A.

Price: \$ 27.50 postage paid, prepayment required.

Orders to: ASAE, P.O. Box 410, St. Joseph, MI 49085, U.S.A.

Sea Level, Ice, and Climatic Change. I. Allison, editor. International Association of Hydrological Sciences Publication No. 131. IAHS, 1981, 471 p.

This publication contains the proceedings of a symposium held at Canberra in December 1979.

The major objective of the symposium was to review current ideas and recent results on the processes and the effects of interactions between sea level, ice, and climatic change on time scales of 100 to 10000000 years. While the cryosphere has been the subject of considerable speculation regarding the climatic past and future, the exact causal relationships between cryosphere phenomena and sea level in the past remain uncertain. Description of those changes in sea level and ice sheets which had causes and effects other than climatic, would hopefully define a residue of features with direct climatic implications, and help to identify interconnections between the three phenomena.

The contributed papers cover a very wide range of topics, showing the complexity and multidisciplinary nature of the study of relationships between sea level, ice, and climatic change.

The publication contains the 6 invited review papers and the 27 contributed papers. Part 1 considers details of the interaction of the short-lived elements of the cryosphere with weather and climate. Part 2 deals with evidence of changes in the late Quaternary and with some current theories on the interaction of sea level, ice and climate.

Price: \$ 50.00; or: FF 250.

Orders to: Office of the Treasurer IAHS, 2000 Florida Avenue NW, Washington, DC 20009, U.S.A.; or: IUGG Publications Office, 39 ter Rue Gay Lussac, 75005 Paris, France.

Proposals for Coordinated Research on

**THE NATURE AND PROPERTIES OF
SOIL COLLOID SURFACES**

Report of a Meeting held in the Groupe de Physico-Chimie Minérale et de Catalyse, Boltzmann Building, Place Croix du Sud, Louvain-La-Neuve, Belgium, on September 30th, 1981 (ISSS Working Group CO).

1. INTRODUCTORY REMARKS

G. H. BOLT, M. G. M. BRUGGENWERT, M. H. B. HAYES, A. HERBILLON and R. PROST

A proposal was put forward at the XIth I.S.S.S. Congress in Edmonton to establish a new ISSS Working Group to promote a concerted effort on studies of the nature and properties of soil colloid surfaces. Following the collection of information from a world-wide selection of soil and clay scientists a meeting was held in Louvain-La-Neuve on October 4th, 1978, and the proceedings were reported in ISSS Bulletin, No. 55, pp. 26-29, 1979. At that meeting a *Steering Committee* was nominated, and is composed of J. P. Quirk (Australia, Chairman), G. H. Bolt (The Netherlands, Vice-Chairman), M. H. B. Hayes (U.K. Secretary), A. Herbillon (Belgium), M. M. Mortland (U.S.A.), and U. Schwertmann (W. Germany), and in addition a *Committee at Large*, was appointed, composed of 16 soil and clay scientists distributed throughout the world. The reader is referred to the ISSS Bulletin reference above for an account of the discussions which took place at the October 1978 meeting, and for an outline of six topics which were suggested for consideration. Suggestions were put forward for a series of *Position Papers* which would summarise aspects of the state of knowledge in selected areas relevant to soil colloid surfaces. These papers were submitted during 1979 and were circulated to members of the Steering Committee and of the Committee at Large, as well as to a number of scientists who had expressed interest in the area of research.

The purpose of the meeting reported here was to discuss the aims of the original proposals in the light of the difficulties of obtaining funds for research from commercial sources because of the recession in world trade since the original suggestions were put forward. It was also considered highly important to prepare the Position Papers for publication (see Section 2, below) in order to remind the scientific community of the importance of the subject area and of its relevance to increasing uses of soil for the production of food and fibre.

1.1. General Objectives

The members present considered that the Organisation should give consideration to possibilities for increasing research cooperation and efficiency between members of Commissions II and III, especially those engaged in research on soil colloid surfaces by:

- (1) providing a global inventory of the relevant research being carried out in this area and of the research which is needed to satisfy the requirements of soil and clay scientists;
- (2) providing a global inventory of what is and of what is not known in the relevant areas, then to define the problems which might be tackled, and to decide which of these problems should be given priorities.

In order to accelerate research in selected areas the members felt that the Organisation should attempt to help researchers to greater efficiency by:

- (i) promoting contact between different research groups. This would involve the organisation of meetings between groups involved in studies in related areas of the overall project, and, in general, coordinating the efforts of different workers in the field; and
- (ii) the foundation of data banks, the establishment of inventories of acceptable practical procedures, and the accumulation of reference soils which would be available to research personnel involved in the collaborative programme.

1.2. Procedures for Progress

In order to further the aims of the Organisation it was considered important:

- (a) that the Organisation be given a name;
- (b) that funds be found to bring the Steering Committee and as many as possible of the Committee at Large together for a meeting lasting three days or so to define details of the most relevant areas of research. Some preliminary contacts suggest that the E.E.C. Secretariat might consider providing a contribution for a meeting of this kind; and
- (c) that urgent consideration be given to ways of funding collaborative projects in relevant and approved areas of study. Consideration was given to the availability, at the present time, of funds for projects in

which studies of the nature and properties of soil colloid surfaces would be relevant. It was considered, for instance that many topics relevant to the project could be legitimately supported by EEC funds which are now available for research on *Soil Degradation*.

2. POSITION PAPERS

The papers which follow in this section are intended to give some indications of the information which is available in different areas relevant to studies of soil colloid surfaces and of that which is needed in order to understand better the important processes which take place in the soil environment. The first three papers deal with material properties of the inorganic and of organic colloids. In the first of these the relevance of model clays or 'museum specimens' from deposits to the more complex structures which occur in soils is considered. The paper emphasizes that the properties of the complex colloidal conglomerates in soil do not necessarily add up to the sum of the properties of the individual components, and that the extents of the active surfaces available for interactions may be significantly less than the total surface areas of the colloids present. It points out the necessity of applying the same rigour to the identification of soil inorganic colloidal structures as was used in identifying reference clays, and of using procedures which will provide more comprehensive information about the composition and properties of natural soil aggregates in which the inorganic and organic colloids are associated with macroscopic soil constituents.

The second paper concentrates on the nature and properties of the soil oxides and hydroxide colloids and outlines aspects of their structures, surface properties and formation and of their interaction with other soil constituents. Methods are outlined for the study of oxides in soil and attention is given to the usefulness, for comparison with authentic soil specimens, of model oxide substances which can be readily synthesized in the laboratory.

In the third paper an outline is given of the concepts of the structures of soil organic colloids and of the mechanisms of their binding to the soil inorganic constituents. It is clear from the data available that the structures, and in particular those of the humic substances, are highly complex, and that it will take a substantial concerted effort in order to resolve these in the detail which is desirable in order to understand the mechanisms of many of the interactions which involve humic colloids in the soil environment.

The second three papers focus attention on solid-solid and on solid-liquid interactions at soil colloid surfaces. The first of these (paper 2.4) considers solid-solid interactions which are particularly relevant in domain, microaggregate, and aggregate structures, and it also takes account of modern concepts of the nature and properties of water at the colloid (in particular clay) surfaces. In the second paper (2.5), consideration is given to the effects of soil colloids on microbial activity and in particular to the effects which these colloids have on the functioning of extracellular enzymes. Soil chemists who prefer to use laboratory models, such as soil or clay suspensions, can often forget the essential contribution which the varied and vast microbial population makes to soil fertility. This paper will cause the reader to reflect on the extent to which microorganisms and the products of their metabolism can influence reactions at colloid surfaces, and to conclude that models which ignore the contributions to soil processes of microbial cells and of biological molecules cannot be wholly valid.

The final paper (2.6) stresses that a knowledge of interactions between the solid (soil colloids in particular) and liquid (soil solution) phases is essential to studies in soil chemistry, and that this knowledge aids our understanding of several other subdisciplines of soil science, such as soil genesis, soil fertility and soil pollution. Because of its complexity, one approach to the study of the reactivity of soil is to investigate the interactions of a solute or adsorptive with the different components or fragments of the solid phase, and then to try to integrate the information for the different component systems to provide some concepts of interactions in the composite soil. This involves a 'modelling process', and a distinction is made between static and dynamic models, and consideration is given to modelling procedures, and in particular to the value of, and the pitfalls in the use of computer models. There is a discussion of the adsorption properties of clay mineral, (hydr) oxides, and organic components, and of the relevance of model studies in which such adsorbents constitute the solid phase. Attention is given to solid-liquid phase interactions during the movement of solutes in soil columns. This approach makes use of composite dynamic models because it is necessary to take into account the flow pattern of the liquid phase. Reference is made to the difficulty of interpreting isotherm data obtained in this way; however, such interpretations are inherently much simpler than those for behaviour in the field where the effects of varying moisture contents and carrier fluxes, as well as changes in the amounts and properties of the adsorptives (e.g. from chemical or biological degradation of organic components), require the use of complicated computer models.

The position papers do not attempt to give text book descriptions of the structures of soil components, or of their reactivities, although in some instances it was considered necessary to give, in broad outline, the gross structures and types of reactions which are considered important. To provide a comprehensive account of what is known and of what requires to be done would be a major undertaking for a number of scientists in the fields of soil and clay mineralogy and chemistry, and in soil biology and biochemistry. Because such is impractical at this time it is hoped that the brief contributions which follow will encourage the readership to forward to the Steering Committee their views about research on the nature and properties of soil colloid surfaces which will be of value in the short and in the long term for the production of food and fiber in agriculture and the preservation of soil as an environmental factor.

2.1. Mineral Soil Colloids

A. J. HERBILLON^{1), 2)} and P. CLOOS²⁾

Clay mineralogy, having largely benefited from contributions of the exact sciences such as physics and physical chemistry, has been developed with a deep concern for rigour. This has led clay scientists to study samples which are often selected for their purity rather than for their representativeness, and to establish for such 'museum specimens' close relationships between their structural and crystallochemical characteristics on the one hand, and their surface properties on the other. In such cases a mineralogical identification conveys rather good predictive values concerning the behaviour of the identified mineral under specified external conditions. In contrast, for clay minerals in soils, such predictions are not necessarily valid. For instance, identification of a smectite in a soil does not automatically mean that that soil will have swelling properties; similarly, identification of an illite in a soil does not give much information about the content and availability of potassium.

In its applications to soil science, clay mineralogy has also been influenced by other concerns. When pedologists raised with clay mineralogists questions concerning the reasons for the occurrence of various types of clays in different soils, they were primarily interested in the factors and processes of soil formation which are responsible for a given clay association, and were less concerned with how clays might interfere with, and possibly control different soil processes.

Nowadays, due to justified pressures for a more utilitarian approach, the 'objective' soil classification systems are progressively taking precedence over the old 'genetic' ones. In this context, soil clay mineralogists are facing the challenge to make their studies more predictive.

From the above it is clear that two complementary approaches to the study of soil properties and mineralogical composition are needed. The first approach is to characterize a variety of soil clays in comparison with the pure reference clays established by the clay mineralogists. The second approach is then to observe how these clays interact and affect both each other and ultimately the properties of the soil.

In practice, soil mineralogists should bring into their studies the same rigour as was used for the 'model studies' mentioned above. It has often been recognized that the qualitative (or at best the semiquantitative) character of our mineralogical inventories of soils presents a serious limitation to their systematic use. For instance, this qualitative character makes clay mineralogy a poor and inconvenient criterion for use in soil classification based on quantitative data. At the present time, several soil mineralogical studies, especially those dealing with large numbers of samples, are restricted to lists of structural and sometimes chemical similarities between the samples under investigation and the reference minerals described in the textbooks. From such studies it is not possible either to evaluate how dissimilar the soil clays are with respect to their models, or to discover why the same name given to similar constituents may have a different connotation in relation to the behaviour of a particular soil (cf. the examples of smectitic and illitic soils mentioned above).

The qualitative character of our clay mineralogical inventories seems to be largely due to the fact that the identification procedures in common use are not only tedious but also rather inaccurate. There is no single technique available at this time which can provide a rapid and reasonably accurate identification of a soil clay, the application of several techniques being generally necessary. Some priority should therefore be given to improved procedures for clay identification. More attention should be given, particularly, to an assessment of dissimilarities between soil clays and their 'standard' counterparts. We are learning that even the clay mineralogical families, which at first sight appeared to be simple, in fact hide a broad variability. Soil mineralogists should appreciate this variability and investigate not only the causes but also the consequences of soil clay heterogeneity on soil properties.

In line with the second approach, it is equally important to keep in mind that the properties of a complex colloidal system such as soil are not necessarily equal to the sum of the properties of each of its components. However, a thorough knowledge of those components is essential for persons who have to understand the system, although quantitative soil mineral analysis alone does not provide enough information.

The work of micromorphologists has shown us that the different minerals present in the soil exhibit various types of mutual organization, and that, for instance, the magnitude and the nature of the clay surface present in natural aggregates may be far removed from the properties deduced by examining separately the constituents of those aggregates. In practice, the behaviour of colloid associations is usually more important than the nature, and even the individual properties, of their constituents.

As soon as it was evident that compounds such as crystalline and short-range ordered oxides (and carbonates) might interfere with the surface and charge properties of common clay silicates, numerous experimental studies were undertaken to describe the nature of these interactions, as well as the different parameters controlling their occurrence. The extent to which these experimental systems represent the naturally occurring mixed aggregates has yet to be established, since detailed studies of natural aggregates are very few when compared with the large amount of information at hand for 'in vitro' counterpart (e.g. hydroxy-aluminium-montmorillonite systems). Instrumentation is now available for observing and analysing in situ

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the bulk and the surface composition and properties of small-sized particles, and we believe that such observation should not be restricted to studies of 'in vitro' samples. In other words, it is time to introduce to our microscopes, microprobes, etc. unchanged and impure soil aggregates taken directly from the field.

This approach, being complementary to those already used by micromorphologists, should, hopefully, throw new light on old and still unsolved problems, such as the coating of one surface by another, the effects of cementing on stability, microporosity, etc... Another and important advantage in studying soil materials as they are, rather than their synthetic, hypothetical counterparts, is that the barriers between clay mineralogists and scientists in applied fields of soil science may be broken down, and hence favour mutual understanding and interactions.

2.2. The Significance of Oxides for the Surface Properties of Soils and the Usefulness of Synthetic Oxides as Models for their Study

U. SCHWERTMANN¹ and R. M. TAYLOR²

Oxides and hydroxides of Al, Fe, Ti and Mn are ubiquitous pedogenic minerals. Because commonly of extremely small particle sizes, and thus of high specific surface areas, these oxides exert a strong influence on the properties of many soils. Among these the degree and stability of aggregates, and the retention of inorganic and of organic ions and molecules are the most important. These influences are partly based on, but also complicated by a possible interaction between oxides and other soil components. It is therefore difficult to study the role of oxides on bulk soils. There, because the same oxides can easily be synthesized under near pedogenic conditions in the laboratory (in contrast to clay silicates), it is felt, that studying these model substances might be of considerable use in understanding their behaviour in soils. This will be more valid the more similar in surface area, crystallinity, crystal chemistry etc. the synthetic minerals are to those formed in soils. Synthesis work in recent years has indeed shown that by approaching more and more conditions prevailing in various soils it is possible to produce oxide minerals very similar to their pedogenic analogues.

The following discussion intends to point out briefly the present state of knowledge in the field of the pedogenic oxides particularly with respect to the surface properties of soils, the gaps which need to be filled, and the ways by which model studies could possibly help to gradually fill these gaps.

2.2.2. State of and Gaps in knowledge

a. General

The common metallic oxides found in soils are those of Al, Fe, Mn and Ti. Although higher concentrations of Ti, Al and Mn oxides are present in some soils, Fe oxides are the most common and generally constitute a larger proportion of the soil minerals than these other oxides in the majority of soils. The number of different minerals within this group (called 'oxides' for brevity) is relatively low. Because much more knowledge has been accumulated in the field of Fe oxides, the state of knowledge can best be demonstrated with this group of minerals.

b. Morphology, crystallinity and crystal chemistry

A lack in definite morphologies and clear x-ray diffraction peaks has led many workers in the past to believe that most of the pedogenic oxides are amorphous. Although more recent work using improved and new techniques (such as Mössbauer spectroscopy and Differential x-ray diffraction; Schulze, 1981) have clearly demonstrated this not to be true, it has also shown that most of these oxides are indeed of low crystallinity and of indefinite crystal morphology. In fact, two forms of Fe oxides of poor crystallinity, *ferrihydrate* and *feroxyhite* have only recently been detected. Since described and named by Chukrov, *et al.* (1973) they have subsequently been found in numerous places (Schwertmann & Fischer 1973; Carlson and Schwertmann 1981 a,b). Ferrihydrate consists of spherical particles between 2 and 8 nm in diameter and has a high surface area of 250–500 m²g⁻¹.

However, the common Fe oxides goethite and hematite quite often also consist of small crystals exhibiting a high, although somewhat lower surface area than ferrihydrate. Gibbsite is usually of higher crystallinity and it is not known for sure if an Al analogue to ferrihydrate exists in soils. It is most likely to be expected in young soils of high weathering intensity where Wada, *et al.* (1976) have detected a compound of similar nature. It may in fact be identical with allophane-like compounds of high Al/Si ratio. Among the Ti oxides, *anatase* (Hutton 1977) and among the Mn oxides, *birnessite*, (Mackenzie 1977) appear to be the most common pedogenic forms, and they both consist of small crystals. A Mn-compound of similar poor crystallinity as ferrihydrate was described by Chukhrov (1979) and named *vernadite*.

Synthesis experiments suggest that it is likely that various soil constituents, particularly those in solution, interfere with nucleation and crystal growth and therefore influence crystal size, morphology and

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order. Constituents in the soil solution can also result in a complex crystal chemistry of Fe oxides similar to clay silicates. Thus, Al, being a frequent compound in the soil solution, can enter the lattice and replace Fe. In fact, Al for Fe substitution seems to be widespread in soils. The degree of Al substitution was found to be related to Al availability in soils and can therefore reflect pedogenetic environments (Fitzpatrick and Schwertmann 1982). It remains to be seen if other elements, such as Si (Murad 1979), Ti (Fitzpatrick *et al.* 1978) and Mn may also be incorporated into the structures of Fe oxides. Recent experiments (Golden 1978) have shown that Al for Fe substitution changes the surface area of Fe oxides by varying crystal morphology, and also changes the nature of the surface functional groups and their retention behaviour against phosphate. Furthermore, dissolvability and reducibility in soil environments are likely to be altered. Much more detailed work is therefore necessary in order to study the crystal chemistry of pedogenic oxides and the conditions which determine their extents and types of isomorphous substitution.

A group of Fe oxides which may explain the green-blue color of some hydromorphic subsoils are the so-called green rusts. These include Fe (II, III) hydroxy salts with various anions and again the possibility exists of Al for Fe (III) substitution (Taylor 1980). They may be related to the observation that higher phosphate adsorption is observed after water-logging of soils (Willet 1978).

c. Surface properties

Oxides are usually constant surface potential colloids. Their charge is thus of the so called pH-dependent nature and arises from the adsorption or desorption of protons or hydroxyl ions which are potential determining ions.

On exposure to moisture, which condition would apply on most soils, it can be assumed that oxide surfaces are hydroxylated, whether in fact they are pure anhydrous oxides *sensu strictu* (e.g. Fe₂O₃), pure hydroxides (e.g. Al(OH)₃), or oxy-hydroxides (e.g. FeOOH) in order to satisfy valence demands at the surface. However, the surface of e.g. goethite exhibits singly, doubly and triply coordinated OH groups, the relative proportion of which is different at different crystal faces (Cornell *et al.* 1976). With regard to surface activity, the degree of coordination appears to influence their ability to react with specifically adsorbed ions such as phosphate, or with protons during the dissolution of goethite. In both respects singly coordinated OH groups are more reactive than those groups which are coordinated with 2 or 3 underlying Fe atoms. The types of functional groups and their relative proportions will therefore influence the surface properties of the oxides, and in turn those of the respective soils. This will depend on crystal size and morphology, but most probably also on the type and extent of isomorphous substitution. Very little is known so far about the type and amount of functional groups of Fe oxides in soils.

The early observation by V. Schuylenborgh (1954) that natural Fe oxides have zero points of charge, lower than pure synthetic ones, has only recently been considered again, and it has been shown for ferrihydrite that adsorbed silicate was the reason for this decrease of the z.p.c. (Schwertmann, unpubl.)

An important practical aspect in this field is that of the retention of nutrients and of environmental pollutants on oxide surfaces. Coordination complexes with phosphate and silicate are formed with Al and Fe atoms at the oxide surface (Parfitt *et al.* 1975) and these cause the surface charge to vary. Pb and Co react with Mn (Mackenzie 1972), and arsenate with Fe and Al oxide surfaces (Hildebrand and Blum 1974; Oscarson *et al.* 1981). The literature contains many references to the adsorption of ions at the surface of synthetic oxides, and a summary is given by Taylor & Schwertmann (1977) and by Parfitt (1978).

The surface activities of oxides in soils might change with time. However, whereas an increase in crystal size and structural order may be a very slow process, because many soil components retard crystal growth, a fraction of the oxides might be involved in a frequent dissolution-precipitation process. Electron transfer in hydromorphic soils might achieve this with Fe and Mn oxides, and proton transfer might do so with Al oxides. A certain fraction of Fe oxides in hydromorphic soils may exist as ferrihydrite. Nothing is known about the rate of reduction of various Fe and Mn oxides by anaerobic microorganisms.

d. Formation

The mode of formation and the properties of oxides (such as the cell parameters of goethite) are related. Furthermore, the occurrence and non-occurrence of certain oxides strongly and sensitively reflect soil genesis conditions. Thus, whether hematite (red soils) occurs in a soil, or only goethite (brown-yellow soils), depends on a number of factors which constitute the pedoclimate in space and time. Also, the occurrence of lepidocrocite and its association with goethite reflect certain microenvironmental conditions in the soil at the place where these two oxides are formed. The type of Mn oxides might reflect pH conditions as suggested by the Li/Ca ratio in the two common Mn oxides (Taylor *et al.* 1964). The significance of Al substitution in goethite for elucidating certain pedogenetic environments was mentioned earlier in this report.

Although of primary interest to soil genesis, the ways different oxides are formed should be better understood because these influence the surface areas and properties of the products. Field observations in conjunction with numerous synthesis studies have yielded much information about the mechanism of formation of Fe oxides (Schwertmann and Taylor 1977). Less information is available for Al oxides, especially for the three Al(OH)₃ polymers, and for the 'amorphous' form which seems to exist in young soils of high weathering activity. Even less is known about the formation of Mn and Ti oxides. With Mn oxides it is most likely that the main step - oxidation of Mn²⁺ - is in many instances microbiological (Wada

et al. 1978). However, the conditions for the formation of the various Mn oxides are not clear, but it is believed that pure MnO_2 (pyrolusite) will only form in the absence of foreign cations, just as foreign ions can cause pseudo-boehmite rather than gibbsite to form. With Ti, recent synthesis and soil studies have shown that Ti released from primary minerals probably precipitates as poorly crystalline anatase, or as a mixed Fe-Ti-oxide such as pseudo-rutile (Fitzpatrick *et al.* 1978). The merits of these studies is that they attempt to elucidate the conditions under which oxides should be prepared in the laboratory so as to resemble as much as possible those in soils.

e. Interaction of oxides with other solid soil constituents

It is a general belief that oxides reside on, or are bonded to surfaces of other soil minerals of various particle sizes. This cements 'inactive' particles together and, if the particles are charged, changes the surface properties. Indirect evidence of this interaction has been presented many times through a change of charge characteristics and of aggregation after removal of synthetic oxides from, or addition to, soils or clay minerals. However, extraction procedures (such as CBD) are never strictly specific for a certain oxide, nor were the oxides added to or formed in the presence of other soil constituents necessarily identical with their pedogenic analogues mainly because of different conditions of formation. Therefore, more direct evidence of the interaction is necessary, and recent studies, combining high magnification electron microscopy with electron microprobe analysis, appear promising in so far as learning more about these interactions is concerned. (Fordham and Norrish 1979).

Not much is known about the different affinities of the various oxides for the surfaces of other minerals, especially clay silicates. Al oxides, because of their relatively lower tendency for hydrolysis in solution, can pertain positive charges in the acid pH range of soils; they can, therefore, be absorbed at the surface of clay minerals and neutralize negative layer charges. Fe oxides, on the other hand, because of their much higher tendency to fully hydrolyse, do not develop Coulombic positive charges in the main pH range of soils. For their retention by soil components, forces other than Coulombic ones might therefore be of greater importance. Electron microscopy, however, very often show that Fe oxides exist as separate micro-nodules apart from, and not associated with rather clean kaolinite crystals (Kämpf 1981). Nothing is known about the situation for Ti and Mn oxides in this respect.

Through the adsorption of oxides on the surfaces of other soil minerals the surface properties of both components will be changed in magnitude and possibly also in character through mutual neutralization or interaction. Oxic soils may loose most of their (naturally low) permanent charge, and consequently their ability to retain cations essential for plant nutrition.

Lines of further research in this field should include the improvement of methods for selectively extracting certain oxidic compounds from soil. This should focus on the extraction of the more reactive fraction of a certain oxide, rather than on its total amount, as has been tried with acid $CaCl_2$ and acid NH_4 oxalate. Also, more high magnification electron microscope observations, as well as surface chemistry measurements (ESCA) should be made.

2.2.3. Modern Methods for the Study of Oxides in Soils

High magnification *electron microscopy* should be used more intensively to study the morphology of pedogenic oxides, although good resolution is difficult to achieve with the extremely small particles. To do this effectively, optimal dispersion is essential; the conditions for this are widely unknown but should be studied. Furthermore, the relation between the morphology of oxide crystals and certain pedo-environments is still obscure.

Methods for the qualitative description and quantitative estimation of oxides in soils need further improvement. A concentration procedure for Fe oxides in kaolinitic soils (Norrish and Taylor 1961) has been used with great success in recent years and was recently reevaluated (Kämpf and Schwertmann 1982). *X-ray diffractometry* (XRD) still remains one of the most important tools for qualitative and quantitative determinations. An improvement was achieved recently by subtracting the x-ray trace of the sample after removing the Fe oxides selectively from that of the untreated sample (Differential-XRD) to obtain a more or less pure Fe oxide spectrum (Schulze 1981, Schwertmann *et al.* 1982). In order to arrive at realistic figures for quantification it is necessary to use standards as similar to the forms in soils as possible. Obtaining the standards from soils themselves is one possible way (Kämpf and Schwertmann 1982), but this has its limitations (purity). Furthermore, XRD is a suitable mean to estimate particle size and isomorphous substitution of Fe oxides. Crystal morphology might be deduced from differential line broadening (Schwertmann *et al.* 1979).

In recent years *Mößbauer spectroscopy* has emerged as a powerful tool for studies of soil Fe oxides, particularly at low concentrations. Parameters obtained from spectrograms, such as isomer shift, quadrupole splitting and internal magnetic field are indicative of the type of oxide, crystal size and of isomorphous substitution. However, spectrograms of soil Fe oxides are sometimes very complex and their full interpretation appears difficult. Much more experience is necessary and more Mößbauer spectrographs should be installed in soil laboratories.

Infra red spectroscopy has shown its merits in order to understand the type of bonding involved between surface functional groups and ions, such as phosphate, carbonate, and sulphate (Parfitt *et al.* 1975, Russell *et al.* 1975). Also Si-O-Fe bonds due to silicate adsorbed by ferrihydrite surfaces, were detected in IR spec-

tograms (Schwertmann and Fischer 1973, Carlson and Schwertmann 1981, Hemmi *et al.* 1980). DTA besides indicating the type of oxide present also reflects particle size (cf. goethite; Derie *et al.* 1976) and Al substitution.

Several methods are available to study the charge characteristics of oxides; these include ion adsorption, potentiometric titration and electrophoretic mobility measurements. These methods should be used to a greater extent on natural oxides and on a greater variety of synthetic oxides, and on soils with oxitic natures.

2.2.4. Use of Model Substances

The ease with which oxides can be synthesized in the laboratory offers a chance to learn more about those in soils by studying simulated models. This could apply to every single aspect of oxides dealt with in the preceding sections.

By varying the conditions during synthesis oxides can be produced having a wide range of *crystal morphology, crystal size, surface area, and isomorphous substitution*, not to speak of the various *types of oxides*. This applies fully to Fe-oxides, and to a lesser extent to those of Al, Ti, and Mn. These model substances should be produced in larger quantities to establish a bank of model samples, and these should be characterized in different laboratories by a great number of different methods to determine solubility, crystallinity, surface properties, etc.. The suitability of these test samples for studies relevant to soils should be derived from their similarities to those present in soils, particularly with respect to morphology, crystallinity, and (partly) to those properties, such as crystal chemistry, which can be determined regardless of their interactions with other soil constituents.

In this way Fe oxides can be produced which are very similar to their soil analogues. Thus, goethites with the same small crystal sizes and degree of Al substitution were produced from the oxidation of Fe (HCO_3)₂ solutions (Taylor and Schwertmann 1978). Goethites which range in surface area between 30 and 200 m^2g^{-1} can be synthesized, depending on the conditions used during synthesis. Lepidocrocite, a well crystalline variety common in hydromorphic soils, can be synthesized by the slow oxidation of a Fe(II) system at pH ~6, whereas a poorly crystalline form – analogous to pseudoboehmite – which exists in nature as well – forms at pH 4–5 during rapid oxidation, or in the presence of some Al. Finally, ferrihydrites similar to natural ones form on partial hydrolysis of Fe(III) salt solutions at low pH, rather than by rapid hydrolysis on adding a base up to $\text{OH}/\text{Fe} \sim 3$.

It can be expected that, if they are similar to pedogenic oxides in crystal properties, synthetic oxides should also resemble those in soils in their *surface properties*. However, this has to be carefully checked by measuring a number of surface properties, such as surface area, zpc, retention of various ions and molecules, aggregation properties etc. Again the influence of isomorphous substitution should be considered.

However, since surface properties of natural oxides cannot be easily measured, because of their admixture with other components, similarities between natural and synthetic oxides has to be deduced from comparative, correlative relationships. Also, the isolation or removal of oxides from soils may be used for further comparison.

The way model substances are synthesized also supplies information on their modes of *formation in soils*. This again is based on their similarities to the pedogenic oxides with regard to crystal properties, and additionally on the similarities of the conditions of synthesis to those existing in soils (Me-concentration, pH, Eh, temperature, foreign compounds in solution, rates of hydrolysis and oxidation etc.).

Finally, the effect of oxides on the surface properties of soils should be studied by producing models in which *oxide-soil compound-interactions* are simulated. To do this, oxides of various types should be added to, or produced in the presence of clay silicates and other soil components of various mineralogical nature and particle sizes. When synthesizing oxides in the presence of soil components, again, conditions close to those in soils should be maintained. For example, for the synthesis of Fe oxides, very often Fe(III)-salt solutions were slowly hydrolysed in the presence of clay at very low pH (1–2) values unnatural to soils.

These soil-oxide mixtures should be characterized by their surface properties and by varying their compositions aiming at a gradual approach to natural soils. In order to do this a number of standard soils, whose properties are strongly influenced by their oxides, should be selected and made available to the co-operating laboratories.

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2.3. Organic Colloids and Organo-mineral Associations

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2.3.1. Introduction

The different colloidal constituents of soils, such as clays, oxides and hydrous oxides of Al, Fe, Mn, Si, and Ti, and the organic materials can each be present as separate entities, or they can be combined in highly complex 'conglomerate' structures. Adsorption, for instance, by the soil colloids will depend on the nature and the properties of the surfaces which are exposed and available for interaction with adsorptive molecules in the soil solution. Many potentially reactive sites on a soil clay may be masked by a coating of hydrous oxide materials, and in turn much of the surfaces of these may be coated with adsorbed humic polymers. In such cases the complex soil colloid adsorbent would have surface properties which could be attributed to clay, hydrous oxide, and humic components. Although such associations are known to compose most soil colloids to greater or lesser extents, there are no accepted mechanisms of how the interactions take place, and there is a great gap in our knowledge at the molecular level of the structures of the associations, and in some instances of the components of the associations.

Humic substances and polysaccharide materials are the most important of the colloidal components of soil organic matter, and these are the major concern in this position paper. Humic substances are distinguished from the other components of soil organic matter on the basis of their solubilities in aqueous acids and bases. Humic acids are precipitated from solution in dilute base when the pH is lowered (conventionally to 1) by addition of acid. Fulvic acids remain soluble in acid and base, and humin materials are insoluble in aqueous acids and bases. These substances are present to some extent in all soils and may compose as much as 85 per cent or more of some humic histosols. Humic acids are the most abundant of the three, and these generally compose more than 70 per cent of the soil organic matter in fertile, well aerated soils where the humification process is not inhibited.

Humic substances are brown, amorphous polyelectrolytes. Fulvic acids are the most highly oxidized of the three components; they have the lowest average molecular weight values and the highest cation exchange capacities (with CEC values ranging from about 5000 to 7500 $\mu\text{eq g}^{-1}$). Humic acids, which can be considered to be significantly the most abundant of the naturally occurring polymers, have CEC values in the range of 3000–5000 $\mu\text{eq g}^{-1}$. Less is known about humin materials, but these are often considered to be intimately associated with the soil inorganic colloids, to have significantly lower CEC values and more complex structures (hence their decreased solubilities) than the humic and fulvic constituents.

For the most part polysaccharides which enter the soil environment are relatively rapidly transformed by microorganisms. The materials which have a degree of persistence are thought to result from microbial synthesis, though considerations of the compositions of sugar residues from soil polysaccharide hydrolysates suggest that some could be derived from plant hemicellulose materials.

Although soil organic colloids may be regarded to be, to a large extent, the end or near the end products of metabolism of soil organisms, they are essential to the fertility of most natural soils. They have high affinities for water, hold plant nutrients by cation-exchange reactions, and above all they play an essential role in helping to stabilize soil aggregates. In addition they act as slow-release reservoirs of nitrogen, sulphur and phosphorus, and humic substances can act as scavengers for heavy metals, and have high affinities for many organic substances (in particular those having aromatic moieties) which enter the soil environment. This last property can be a disadvantage where organic chemicals applied to soil for the control of pests and diseases are adsorbed and inactivated by the humic substances before they are able to reach the target species.

2.3.2. Structures of Humic Materials and Soil Polysaccharides

The authors (Hayes and Swift, 1978) have outlined the state of knowledge in so far as the primary (component molecules) and tertiary (shapes and sizes) structures of humic substances and soil polysaccharides are concerned. In the past some have regarded as components of the polymer structures all of the molecules released into the digests when the macromolecules are degraded by various chemical reagents. We, and others, have pointed out that the identified digest products might be greatly different from the component structures or building blocks of the polymers, and we (Hayes and Swift, 1978) have emphasized the importance of understanding the chemical mechanisms which operate when the polymers are degraded so that the products identified can be related more accurately to possible structural units in the polymer.

Schnitzer and his coworkers (e.g., see Schnitzer and Khan, 1972 and 1978, and references therein) have contributed most to the list of compounds identified in the digests of humic acids degraded by different reagents under different conditions. (Hayes and Swift, 1978, have listed the structures identified prior to 1978). The information which can be obtained from a study of these compounds, taking account of the reagents and procedures used to release them, as well as data from titrations, spectroscopic analysis, in particular infrared (i.r.) and more recently ¹³C-nuclear magnetic resonance (n.m.r.) spectroscopy, allow

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us to make predictions about some of the types of primary structures which compose humic materials.

It is probable that the sugars and amino acids released during the hydrolysis of humic substances originate in oligosaccharides and polysaccharides, and in peptides, respectively; these hydrolyzable parent structures might be covalently linked to, or merely adsorbed on to the humic substances. Covalent linkages might include phenolic glycoside structures in the cases of the saccharides, and Schiff bases, or even direct bonding of the amine nitrogen to carbon atoms *ortho* to the carbonyl group in quinone structures (see structure type I in Figure 1) in the cases of peptide materials.

There is irrefutable evidence for the presence of di- and poly-substituted single aromatic structures in humic polymers. Structure types II and III, Figure 1, show the various combinations of functional groups which have been found in aromatic structures identified in various digests. Compounds containing some or all of the combinations listed in structure type II have been isolated from oxidative degradation processes such as those which use alkaline and neutral permanganate and alkaline cupric oxide reagents. All of the benzene polycarboxylic acids have been identified from such digests, and it is likely that these arose from oxidizable (e.g. alcohol, aldehyde, aliphatic hydrocarbons) substituents, and possibly (but unlikely) from fused aromatic structures in the cases of degradations with permanganate. The presence of aliphatic side chains is confirmed by the identification of ethanoic acid substituents. Because it is necessary to methylate the polymer prior to degradation with permanganate (to prevent the breakdown of phenols) the methoxy (-OCH₃) substituents of II could indicate that phenols contributed to the structures of the parent polymers.

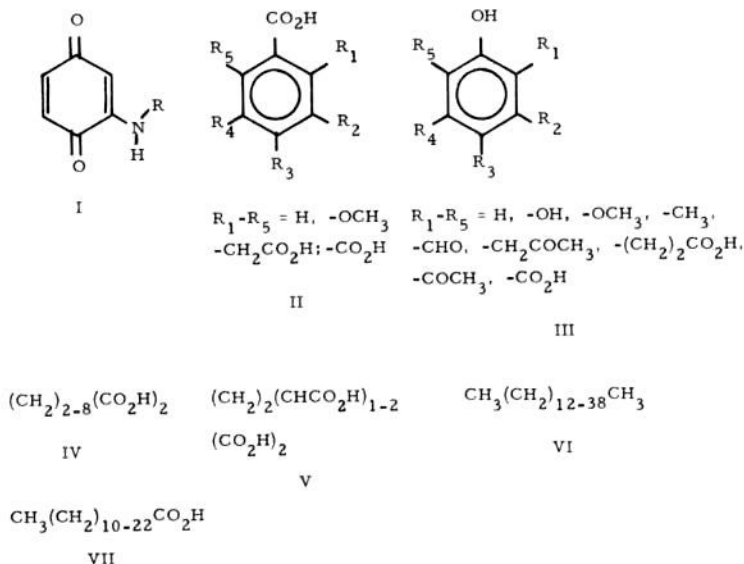


Figure 1. Types of structures found in digests of humic substances degraded by different procedures.

The types of compounds identified among the 30 per cent or so ether soluble digest products of the sodium amalgam degradation confirm the presence of single ring aromatic structures having various aliphatic substituents, including methoxy, phenolic hydroxy, and carboxyl groups (structure type III, Figure 1). It is interesting to note that the aromatic structures released by this relatively mild reductive degradation process (which would not be expected to give rise to significant amounts of artefacts) did not contain more than one carboxyl substituent (several had none). Some nuclei contained up to three hydroxyls and some had two methoxyls and one hydroxyl group (suggestive of lignin origins). Other degradative procedures, such as refluxing with phenol plus *para*-toluene-sulphonic acid, and the sodium sulphide at elevated (250°C) temperature method, have provided additional proof for the presence of aliphatic substituents attached to single aromatic nuclei.

Further proof for the presence of aliphatic structures in humic materials can be found among the products identified by Schnitzer and his colleagues. Structures IV and V (Figure 1) from permanganate degradation reactions could arise from the oxidative cleavages of olefinic structures, and/or from readily oxidizable functional groups (e.g. alcohol, aldehyde). Hayes and Swift (1978) have suggested degradation mechanisms which might explain origins for compounds VI and VII in alkaline copper oxide digests. An alternative explanation, which Dr. Schnitzer takes into account, is that these could represent microbial products which were adsorbed to the humic structures.

Proof for the presence of fused aromatic structures is less convincing because it has not been unequivocal.

cally established that the low yields of polycyclic aromatic structures obtained from zinc dust fusion and distillation processes were not artefacts.

Summarising the foregoing information, and taking into account data from i.r. and n.m.r. spectroscopy, titration curves, and the analysis of functional groups in the polymer structures, it is clear that humic materials contain single-ring aromatic structures, many of which are heavily substituted with aliphatic hydrocarbon, carbonyl, methoxy, hydroxyl, carboxyl, and other side groups. Some of the aliphatic hydrocarbon structures are likely to be unsaturated; some of these may even have a degree of conjugation, and many are likely to contain various functional groups, including carboxyl. All of these need not necessarily be substituents of aromatic structures. There is no evidence which would exclude heterocyclic aliphatic and aromatic structures containing oxygen and nitrogen.

Determinations of the sugar components of soil polysaccharides are relatively simple because of the ability of the glycosidic linkages to hydrolyse in acid media. It is of interest to note that the same sugars appear to be present in soil hydrolyzates regardless of the origins of the soils (see Hayes and Swift, 1978). This observation can readily be substantiated or otherwise when an appropriate variety of soils, and polysaccharides from soils, are subjected (preferably in the same laboratory) to the same procedure of hydrolysis and of analysis of digest products.

Should the synthesis of humic substances be genetically controlled it is reasonable to assume that (although there might be several different polymeric structures) a number of pure polymers of identical secondary structures could be isolated (as, for instance, is the case for proteins and polysaccharides). There is no evidence for such control, and if the polymers should result from random condensation reactions of products of microbial metabolism and the alteration products of plant and animal residues, it is quite possible that there are no two polymer molecules alike. Thus, on the basis of present knowledge and technology, laboratory studies of secondary structures (or the sequence of the primary units in the polymer) would be meaningless. If, however, the primary structures were known, it would be possible to assemble models of plausible secondary structures. Determinations of the secondary structures of soil polysaccharides need not present problems when homogeneous and pure structures have been isolated. Cheshire *et al.* (1979) have already shown that considerable information about linkages can be obtained from the hydrolysis of even impure methylated materials.

The extreme polydispersity of humic materials does not allow meaningful determinations of molecular sizes to be made, except in cases where careful fractionation procedures are first applied. Cameron *et al.* (1972) have interpreted, from ultracentrifugation data, sedimentation coefficients, and frictional ratio values, that humic acid structures have molecular weight values ranging from 2×10^5 to $>1.5 \times 10^6$, and have random-coil conformations in solution. They used fractions which had been carefully fractionated by gel filtration and by filtration through graded porosity membranes.

Studies of molecular conformations are of necessity carried out in solution in the laboratory. It is therefore not strictly valid to extrapolate from solution conformations to the types of tertiary structures which can exist under field conditions. There the humic structures are greatly condensed, as solids, or as gels. Hayes and Swift (1978) have discussed the effects of condensing the random coil structures by addition of acid and/or of di- and of polyvalent metal cations. The process of charge neutralization with ions which are not readily dissociated from the charged species cause solvent repulsion and molecular shrinkage (involving hydrogen bonding, and polyvalent cation-bridging between, and possible within strands) to lead to precipitation. It can be predicted with reasonable certainty that humic substances in the solid and gel states are more compact, more tightly coiled, and much less solvated than those in solution. Nevertheless, these compact structures can be regarded as porous materials, but the porosity will depend on the neutralizing cations and on the amounts of water present.

We still await results of studies of the tertiary structures of soil polysaccharides. The polymers are hydrophilic, and some are polyelectrolytes because uronic acids comprise a significant proportion of the primary structures (at least of the mixtures). It is probable, but not certain, that they assume random-coil solution conformations, although cellulose-type polymers would have linear helical type conformations.

2.3.3. Associations between Soil Organic and Inorganic Colloids

There is good evidence to indicate that associations take place in the soil between the organic and inorganic colloidal components. Not all of the organic colloids in all soils are associated in this way, and there is plenty of evidence to suggest that considerable proportions of the soil organic colloids can remain free in the soil environment.

Adsorption of polysaccharides by soils and clays are discussed in recent reviews by Hayes and Swift (1978), Cheshire (1979), Theng (1979), Hayes (1980), and by Burchill *et al.* (1981). In these, evidence provided by Clapp and his associates is reviewed which indicates that the configurations of the glycosidic linkages (α or β) strongly influence the extents of adsorption (and hence the conformations of the adsorbed species) of dextrans by clay minerals. Not all dextrans are adsorbed, and although the reasons for this are not known they would appear to involve the nature of the linkages between the component glucose units; linkages and structures which allow multiple contacts between the individual glucose units and the adsorbent surface would favour adsorption.

Burchill *et al.* (1981) have outlined the types of conformations which adsorbate (adsorbed) molecules are likely to take up on the adsorbent surface; at low surface coverage there is room for each segment

with an affinity for the surface to adhere to it, but the number of contacts possible between the adsorbates and adsorbents decrease as surface coverage increases. Hence the differential energy of adsorption decreases as adsorption progresses.

The permanent negative charge on clays is of the same sign as that of humate molecules, and it is not surprising that adsorption from solution of the polyanionic species by monovalent cation-exchanged clays does not take place. There is evidence to show that H^+ -exchanged, but water-soluble fulvic acids are adsorbed even in the interlayer spaces of expanding lattice clays because of the weak dissociation of the polymers at low pH values. Similar studies of adsorption of humic acids would require that the polymers remain in solution at equally low pH values (which they do not). Nevertheless, humic acids do associate with soil clays, and a number of mechanisms have been put forward to explain this phenomenon. One plausible explanation is that the humic materials complex with clays through divalent and polyvalent cations, especially calcium, iron and aluminium (Greenland and Mott, 1978; Theng, 1979; Burchill *et al.*, 1981).

Schwertmann and Taylor have referred, in position paper 2.2, to the interactions between oxides and other solid soil constituents, and they have indicated that not much is known about the different affinities of the various oxides for the surfaces of other minerals, especially clay silicates. They have pointed out that Al oxides can become positively charged in the pH range which predominates in many soils; thus they can, through coulombic attraction, neutralize the negative charges on the clays and as a result the surface properties of both components are changed. This gives rise to a second possible mechanism for association between soil organic and inorganic colloids because of adsorption, possibly through ligand exchange with surface hydroxyls. Coulombic attraction between humic materials and positively charged oxides, whether or not they are associated with clays, offers another plausible mechanism of association. However, sufficient consideration has not been given to the possibility that some of the organic/inorganic associations in soils arise from the precipitation, in the presence of metal ions (such as Fe, Mn, and Al), of humic materials on the inorganic surfaces.

2.3.4. Gaps in Our Knowledge

There is available, at this time, sufficient scientific background and enough instrumentation resources to fill most of the gaps in our knowledge concerning the nature and properties of soil colloid surfaces. Our lack of awareness of the precise structures of soil colloids, especially of the organic colloids, is a major gap at this time. It will be necessary to apply modern technology to obtain clearer definitions of all of the structures contributing to the surfaces, and of the manner in which these structures are associated at the surfaces before the properties of soil colloid surfaces will be understood.

a. The structures of soil organic colloids

It has been suggested already (Section 2.3.2) that no two humic polymers may be exactly alike if their synthesis is not genetically controlled, and if the polymers are formed by the random condensation of several reactive chemical species. However, this need not be of particular concern if the chemical units which compose the structures and the shapes of the polymers are known, and if there are good indications of how these shapes vary with the molecular sizes of the polymers.

Progress in humic acid structural studies have been hampered by the fact that different laboratories use polymers of different origins and extracted and prepared by different procedures. There is a great need for several workers to use reference materials, or at least materials extracted from the same soil and prepared by standard procedures. The reference collection of humic materials (see report in this Bulletin) to be kept at the Colorado School of Mines is a step in the right direction in this regard.

Primary structures. It is unlikely that any single procedure will be sufficient to identify all of the component molecules in humic structures, but there is hope that the required information can be obtained from combinations of nondegradative spectroscopy and degradative (involving a substantial energy input) procedures. It would appear that many of the component structures are linked by carbon to carbon bonds, and the energy input required to cleave such bonds would degrade the polymer to products which would be meaningless in so far as the species from which they were derived is concerned. However, use can be made of functional groups present which lower the activation energies required to cleave the carbon to carbon bonds, and in this way it is possible to isolate compounds which can be meaningfully related to structures in the polymer. In order to establish this relationship it will be necessary to understand thoroughly the mechanisms of the reactions which take place in the digestion mixture. For that reason extensive studies should be undertaken with model substances, and especially with oligo and polymeric materials of known compositions and containing component molecules similar to those thought to be present in humic polymers. Such studies would allow interpretations to be made of the bond cleavage processes, and of the additional reactions which the released molecules could undergo during their residence time in the digest under the prevailing reaction conditions. An understanding of the composition of the digest, and of the reaction mechanisms which would prevail in it, would allow plausible predictions to be made of the structures in the polymers which gave rise to the products identified.

Most of the degradation reactions which are used give yields of ether soluble products amounting to 30–40 per cents of the starting (humic) polymer, although yields in excess of 60 per cent have been reported for degradations with sodium sulphide at elevated temperatures and with phenol plus *p*-toluene sulphonic

acid under reflux conditions. Low yields suggest that only limited numbers of bonds are susceptible to a particular degradation process, or alternatively that secondary condensation polymerization reactions take place in the digest involving structures originating in, but released from, the parent polymer. Research effort is required to develop better degradation procedures. It is probable that best results will be obtained using mixtures, or using sequential degradation reactions. Such reactions would have definite advantages if secondary polymerizations can be avoided. For instance, one degradation process might predominantly cleave ether linkages, a second might cleave unsaturated bonds, a third might cleave carbon to carbon linkages activated by hydroxyl substituents on one of the carbons, etc. Consideration might be given to the physical input of energy (e.g. ultrasonication) which would supplement chemical degradation processes.

The development of sophisticated spectroscopic instrumentation and procedures is expected to give valuable information about the molecular components of humic polymers. Such procedures, of course, are non-degradative, and any 'generation of artefacts' would be through false interpretation of the spectra obtained. Infrared spectroscopy has provided valuable information about functional groups and some of the types of linkages in humic polymers, and ^{13}C n.m.r. is providing valuable information about aromaticity, the types of aromatic structures present, and about the ratio of aliphatic to aromatic structures present. ^{15}N n.m.r. is finding useful applications in protein and nucleic acid chemistry and the technique may well prove to be useful for resolving the nitrogen containing structures in humic polymers.

Tertiary structures. The ultracentrifugation studies of Cameron *et al.* (1972), using well-fractionated humic acid samples, having molecular weight values between 2×10^3 and 1.5×10^6 , indicate that humic acids in solution have random coil conformations. Their data suggests that branching becomes more extensive as the molecular weight increases. In that work only material soluble in tris buffer (pH ~ 9) was investigated, and significant amounts of the humic acids were not soluble in this medium. Failure to dissolve might be attributed to lower charge densities, greater branching, higher degrees of cross linking, and many other factors. It is important, of course to know the composition and the tertiary structures of such complex humic materials, as well as their affinities for other soil colloids, and to understand their reactivities towards metals, organic chemicals, etc. Hence consideration should be given to the development of procedures for their examination. This might merely involve the use of suitable buffers and solvents to put the polymers into solution and to allow them to be studied by appropriate physico-chemical techniques.

Hayes and Swift (1978) have assumed that it might not be unreasonable to predict that the conformations of polymers in the solid or gel phases would be broadly similar to those in solution, except that the 'strands' would be closer together in the more condensed forms. This working hypothesis may or may not be broadly valid, and there is a great need to devote thought and research effort to determinations of the conformations or organic polymers in the states in which they are most likely to be present under field conditions.

b. The nature of organo-mineral complexes

In order to provide working models on which to base discussion and proposals we will draw on the information outlined in Section 2.3.2 and assume that humic materials are highly disperse polyelectrolytes having CEC values ranging from 3000 to 7500 $\mu\text{eq g}^{-1}$ contributed mainly by the dissociation of carboxyl group substituents on aliphatic and aromatic hydrocarbon structures, and by phenolic hydroxyls. We will further assume that the polymers have random coil solution conformations and that this general shape is preserved in the shrunk or condensed structures (brought about by the removal of water, or by the addition of acid or of polyvalent cations). Furthermore it will be inferred that any organic soil polymers adsorbed by, or associated with mineral soil components will impede further adsorption or complexing on those portions of the mineral surfaces which are covered. The bound polymers will, however, contribute significantly to the surface properties of the 'conglomerate' soil colloid structures.

We have pointed out that there is a very great gap in our knowledge at the molecular level of the composition of the organo-mineral colloidal complexes, and it is only recently that some plausible explanations can be given as to why some naturally occurring polymers will adsorb whereas others will not. Reference to Clapp's work (in Section 2.3.3) indicates the importance of configuration and tertiary structure in the adsorption of dextrans by clays. Information is now emerging which indicates that there are differences in the types of humic materials which are adsorbed by different mineral components in soils. Such observations offer possibilities for new approaches to studies of organo-mineral associations, and the information which can now be obtained may have considerable relevance to studies of soil genesis and could be of value in considerations of the agronomic properties of soils.

c. Amounts of organic materials bound by different size (soil) fractions.

A recent and very timely publication by Turchenek and Oades (1979) has presented procedures for the fractionation of organo-mineral complexes by ultrasonication, sedimentation and density techniques, and they have provided extensive data which indicate the extents to which organic matter and elements such as Al, Ca, Fe, K, Mg, P, Si and Ti are present in the different density fractions of various soil separates ranging from fine clay ($<0.1 \mu\text{m}$) to coarse sand ($>53 \mu\text{m}$) and whole soils. Their paper provides an excellent base for expansion of work on mineral-organic associations, and it draws attention to variations in the relative amounts of organic matter associated with different size fractions of the same soils. It is evident

from their data that the same trends do not operate for all soils. They cited references to others who have looked at the organic matter distribution in the different soil separates, and to Pokotilo, for instance, who noted that, for Soviet soils, humus was most abundant in the 1–5 μm particle-size range of chernozem surface soils, but that in passing to podzols the clays became richest in humic materials.

Much can be learned by extending the approach of Turchenek and Oades to as wide a variety of soil types as possible. Ultrasonication and density separations, although the best of the procedures available at this time, need further development in order to separate out all of the organic materials which are not associated with the mineral components. The problem of extraction of the residual mineral-associated organic components has been tackled by Turchenek and Oades (1979) by the use of pyrophosphate and pyrophosphate/NaOH solutions, and, of course, determinations of the carbon contents of the residues could indicate humin materials (if it can be assumed that all the plant residues are removed in the light fractions) unextractable in aqueous solvents.

d. Compositions of organic materials bound by different size (soil) fractions.

Turchenek and Oades (1979) have been able to show some differences in the compositions of the organic materials bound to different size fractions of the same soil by measuring carbon contents, sugar ratios in the different extracts, and extinction coefficients (E_{280}). It is important of course to know that different organic materials have different affinities for the various size (soil) fractions, but this information is most meaningful when the compositions of the organic components and of the mineral materials are known. Progress can be made in the case of the organic structures by isolating the polymers and fractionating them on the basis of molecular size differences (by use of graded porosity membranes and/or gel filtration). This would indicate whether or not the mineral adsorbents were selectively adsorbing materials within particular molecular weight ranges. Titration, spectroscopy, and functional group analysis would allow further differences to be observed between adsorbate molecules isolated from different samples. Fractionation procedures are available which would allow polysaccharides to be separated from humic materials, provided that they are not covalently linked to each other.

The best information would be provided by comparisons between the component molecules of the polymers of discrete molecular weight ranges. This would be relatively simple for the polysaccharides, because the hydrolysis products can be readily and quantitatively identified (Cheshire, 1979). The problems of obtaining structurally meaningful products from degradations of humic acids have been outlined above in this section, and we await the development of better procedures for this purpose. Nevertheless, very useful information can be obtained even now by applying the same degradation procedures to all fractions and by qualitatively and quantitatively comparing the degradation products from each reaction.

e. The formation of organo-mineral complexes.

Studies of binding mechanisms by chemical and physico-chemical procedures.

Reference was made in Section 2.3.3 to some of the mechanisms which may be involved in forming and in holding together organo-mineral associations. E_{280} evidence by Turchenek and Oades (1979) suggested that the heavier fine clays contained more aliphatic fulvic and humic materials (indicating the possible involvement of physical adsorption forces) than the lighter and the coarser fractions (where there was evidence to suggest more advanced humification and aromaticity). Consideration might now be given to ^{13}C -n.m.r. analysis of the materials in attempts to find evidence for the extents and the nature of the aromaticities.

In order to bridge the gap in our knowledge of binding of humic polymers to the inorganic colloids consideration might be given to studies using different soil mineral extracts and model mineral structures. An obvious preliminary to mechanistic investigations would be to determine the extents to which the materials extracted would be adsorbed by the mineral adsorbents from which they were removed. This might be followed by 'cross-adsorption' experiments to establish the extents to which samples isolated from one mineral adsorbent are taken up by a second, and vice versa.

It is inevitable that the extraction process would alter the composition of the residual inorganic adsorbent surface. Attempts might be made to regenerate that surface by replacing the ions removed in the extraction process. Extraction, and subsequent handling would also alter the properties of the polymers. Consideration might be given to dialysis of neutralized, or partially acidified extracts (humic acids would still be in solution at pH 5), and to adsorbing the non dialyzable residues. Further consideration might be given to adsorption of these isolates by unextracted source materials to determine whether or not the adsorbent had further affinity for organic molecules of the types present already.

There is much that can be learned from model studies. The traditional approach uses homoionic-exchanged clays and humic preparations. In order to understand better the processes involved it is desirable to fractionate the polymers on the basis of molecular weight differences, and some fractionation on the basis of charge density differences may also be achieved. Such fractions could be adsorbed from solution at pH values around 6. Mechanistic interpretations of the process of adsorption from solution could be made from isotherm and calorimetry data. Further mechanistic data would be obtained from thermogravimetric analysis data of clay-humus complexes.

Careful consideration should be given to possible pitfalls. The most obvious of these would be to interpret as adsorption precipitation from solution; thus it would be important to establish whether or not the

concentration of cation in the medium would cause the polymer to precipitate. However, from considerations of observations by Turchenek and Oades (1979) and others, it would appear highly likely that the polyvalent metals involved in the binding of the more highly oxidized humic substances are largely present as amorphous oxide deposits on, or associated with, the clay surfaces. This would suggest that appropriate oxide synthesis, based on the composition of extracted oxides, and utilising ideas inherent in the contribution to this series by Schwertmann and Taylor, would be an important prerequisite to a fuller understanding at the molecular level of the adsorption mechanisms.

Much can be learned from studies of the binding of simple and polymeric materials of known compositions. Considerable progress has been made in understanding the mechanisms of adsorption of amino acids, sugar molecules, and various pesticide analogues by clays. It is generally accepted that the soil organic components are most active for the binding of aromatic molecules, and hence studies with soil clays (containing bound humic materials) might give ambiguous results. However, studies between clays associated with amorphous oxide structures and model compounds based on structure types outlined in Figure 1 would be of interest. Similarly much could be learned from the binding of synthetic polymers based on phenol carboxylic acid structures with appropriate aliphatic substituents.

There is evidence to show that there are differences in the affinities of different soil polysaccharides for clay preparations (see Hayes and Swift, 1978). Again, there is need to investigate whether or not there are differences in the adsorptivities for soil polysaccharides between the various soil clay fractions. The influence of mineral-polysaccharide associations on the binding of humic substances is not known, nor are the effects on complex formation of polysaccharides adsorbed (or covalently linked) to humic substituents. Crude humic extracts may have as much as 20 per cent associated polysaccharide, and little is known about the influence of the polysaccharide 'impurities' on the adsorption of the humic materials. Adsorption of humic substances before and after hydrolysis of polysaccharide may not provide the answer because hydrolysis will inevitably alter the humic structures. An alternative approach might complex dextrans (known to adsorb) with humic materials and observe adsorption of the dextran-humate complexes.

f. The influence of microorganisms on soil colloid surfaces.

The contribution of biological transformations *in loco* of plant and animal remains to the formation of humic materials must not be forgotten. Flaig *et al.* (1975), have outlined some of the biochemical reactions which may be involved in the transformation processes.

The environment generated by microorganisms in the vicinity of a particle of organic debris and an inorganic colloid will be greatly different from that of similar colloids and humic materials in aqueous media. R. G. Burns has focused attention in Section 2.5.5 on clay-microbial associations which result when clays are incubated in non-sterile nutrient media. Also studies by Berthelin and Dommergues (1976) have shown that amorphous or mucilaginous coatings, with or without microbial structures, firmly adhered to granite particles perfused with nutrient media under non-sterile conditions. Although ultrasonication, and treatment with bromoform-ethanol, ethanol-water and stirring with water failed to remove the deposits they could almost all be removed in 0.5M NaOH. Their data showed that Fe was immobilized by the deposits, and indicated that Si, Al, and eventually K were also contained in these. It would appear that in other experiments by the same authors iron was more extensively immobilized by the high- than by the low-molecular weight fractions.

Thus it is obvious that very considerable attention should be focused on the formation of organic and inorganic colloidal association in non-sterile incubation experiments, and under controlled (aerobic to anaerobic) environments. By appropriate supplies of Fe and Al to nutrient media, the deposition or otherwise of amorphous iron and aluminium hydroxides (associated or otherwise with organic polymers) might be observed on the clays. Extractions (and analysis of extracts) of water-washed clays would allow observations to be made of the types of organic compounds initially associated with the clay surfaces (and possibly of how these associations are bridged). Subsequent observations might indicate how the later products of humification (such as humic acids) may associate with the primary organic deposits. It is not inconceivable that mucoproteins and mucopolysaccharides, for instance, might form initial deposits on the clay surfaces, and that these could act as 'anchors' for the subsequent accumulations of humic materials.

Electron microscopy observations of washed soil clay and of clays incubated in non-sterile media can provide good indications of organo-clay associations. These techniques can also provide indications of how the associated organic materials cause the clay particles to orientate with respect to one another. However, because the samples must be dried such procedures do not give a true indication of the extents of associations between organic and mineral matters.

2.3.5. General Summary and Recommendations.

Organic colloids, independently and in association with inorganic components, contribute significantly to the composition and reactivities of the 'conglomerate-type' structures in soil colloids. In order to understand reactions which take place at these surfaces it is important to know more about the structures in the 'conglomerates', and of how these structures are associated.

Humic structures and polysaccharide materials are the most abundant and important of the soil organic colloids. Comprehensive determinations of the component molecules (primary structures) of humic polymers by degradation procedures awaits the development of techniques which will break the polymer into

identifiable components which can be related to plausible structures in the polymer. This approach will require extensive model studies in order to understand the nature of the degradation processes taking place in the digests. Modern spectroscopic techniques, which are non degradative can give good indications of the types and extents of aromaticity, the types of functional groups present, and possibly of the extents to which such functional groups are attached to aromatic and aliphatic structures.

It is unlikely that studies of secondary structures (or the sequences of primary units in the polymers) would be meaningful except it can be shown that the synthesis of humic materials is genetically controlled. There is, however, a need for an extensive research effort on tertiary structure determinations, especially with regard to the conformations of the humic polymers in solution, and in the gel and solid phases. There is some evidence to indicate that branching and possibly cross linking increases with molecular weight, and the more complex shapes may have a big influence in the binding of heavy metals, and of organic chemicals (e.g. pesticides).

There is sufficient knowledge and technology to resolve the structures of soil polysaccharides. Progress is, however, hampered by the fact that the purification of polysaccharide extracts is tedious.

In order to understand the nature of inorganic-organic soil colloid associations, it will be desirable to carry out model studies with materials (relevant with respect to soil colloids) whose structures are well understood. Fractions of humic substances, relatively homogeneous with respect to molecular weight and of broadly similar charge densities, can be isolated and reacted with clays and hydrous oxides, both singly and in association. Appropriate alterations to the inorganic surfaces (with respect to pH effects, charge neutralizing cations, etc.) should yield significant data for adsorption of the organic colloids. Such results can be related to those for the adsorption of humic substances by soil clays.

Consideration must be given to the reactivities of the components in the 'conglomerate' colloids. It is probable that any procedure which requires extensive drying will create 'surface artefacts' in so far as reactions which take place in the soil are concerned. However, an appropriate approach might be to measure binding by the colloids, both singly and in association, of molecules which are held only by the clays, or by the oxides or by the humic substances under the conditions of testing (A discussion of compounds which would broadly meet these requirements for clays and humic substances is given by Burchill *et al.*, 1981). The decrease in uptake by the inorganic structures might be attributable to coating effects by the organic polymeric adsorbates, and that by the organic colloid might be attributed to its association with the mineral surface, to changes in conformations as the result of adsorption, etc.

Any consideration of the reactivities of soil colloid surfaces in the field should take account of the extensive and highly active population of microorganisms which inhabit the soil environment. Relevant experiments might involve the culturing of microorganisms till humic-type substances are formed from appropriate substrates in the presence of model soil inorganic colloids, as well as of soil colloidal constituents. Isolation and identification of organic materials adsorbed or deposited on the colloids at different time intervals might indicate whether or not the binding to inorganic colloids of humic materials requires the prior adsorption of a different organic substance.

2.3.6. References

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2.4. Studies of Interparticle Forces between Soil Colloids

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2.4.1. Introduction (Prost)

The physicochemical properties of soil materials, the physical properties of soils, the transport through the soil of water, solutes, gas, and heat, and the numbers and activities of the fauna and microorganisms which inhabit the soil are all directly related to the nature of the soil structure.

There is considerable interest in understanding the mechanisms of soil aggregate formation and stabilization, because such understanding would suggest appropriate measures to preserve soil structure. The problem of preserving soil structure is becoming increasingly important to areas of Europe where intensive cultivation practices are used, and where heavy machinery (as used, for example, for harvesting sugar beet and cereals) is employed when the soil is wet and the aggregates unstable. This problem is also important where the techniques and machinery of the technologically advanced nations are introduced without appropriate caution to developing countries.

A knowledge of the strength of the bonds involved in each structure or type of association within aggregates (Cambier and Prost, 1981) would allow predictions to be made of the effects which changes in the physicochemical properties of the components would have on the structures of aggregates.

The forces which bring the constituents together can be of two kinds:

(1) long-range forces which have an electrostatic, or an induction or a dispersion origin. From the wave-mechanics point of view, this means that atoms or molecules are far enough apart from each other for electron exchange to be neglected;

(2) short-range forces which come into play only when the electronic charge clouds of atoms of different molecules or particles overlap. This second kind of forces includes all of the chemical bonds.

2.4.2. Soil Aggregates (Prost)

Aggregation of soil particles will be considered where no bonding agent is involved, and where the bonding agents are oxides, organic matter and water.

a. Aggregation in the absence of any binding agent

The aggregation of kaolinite provides the simplest example. To disperse kaolinite, the exchange capacity of which is of the order of $30 \mu\text{eq g}^{-1}$, it is sufficient to increase the suspension pH from 7 to 9. Afterwards, if the pH is lowered to 7, the clay flocculates. During this procedure no change of the surface area accessible to nitrogen is observed. Examination of such samples by electron microscopy shows that the less than $2 \mu\text{m}$ fraction is in fact composed of microaggregates which results from the face to face association of a few kaolinite crystallites. This suggests that two kinds of bond are involved in the kaolinite structure:

1. the face to face association of crystallites which gives microaggregates;
2. the association of microaggregates.

This second kind of bonding is broken by increasing the pH which provokes:

- a. either the breaking of bonds between aggregates; or
- b. the appearance of charges which would involve repulsion forces which would push the particles apart.

This example illustrates that the nature and the 'bonding' forces which give the cohesion to aggregates are complex and imperfectly understood. It is worthy of note that examination by high resolution microscopy of thin slices of kaolinites from soils has never revealed the existence of other than face to face associations. We think therefore that the association described by Schofield, and often mentioned in the literature are, is, in fact, a consequence of the conditions of the sample preparation.

b. Aggregation in the presence of oxides.

An example is considered of a red soil of Casamance (Sénégal). This soil is composed of aggregates the size of which are about $15 \mu\text{m}$. When 5% of iron oxide is removed by the De Endredy method, which uses UV light, the material is totally dispersed.

Only quartz particles are found in the $2 \mu\text{m}$ fraction (Chauvel 1977). Microaggregates here result from the face to face association of the kaolinite crystallites. Extraction of 0.2% of iron oxide by the method developed by Tamm, using the same reagent of De Endredy (but used in the dark) gave similar dispersion to that obtained with the De Endredy method. It is worthy of note that observations by electron microscopy revealed that the microaggregates are roughly of the same size.

We conclude from these observations that there are at least two levels in the organization of this material:

1. the face to face association of crystallites which gives the micro-aggregates;
2. the association of the microaggregates by means of bonds which implies the presence of iron.

The results of Tamm suggest that a small quantity of iron, located in the aggregates, is involved in the

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cohesion of the material. We suppose, therefore, that the iron which is involved in the bonding of microaggregates is not in the form of an oxide. This could be connected with its greater ability to be complexed by the oxalate anion. This hypothesis suggests several questions about:

1. the nature and the location of the part of iron involved in the aggregation mechanism;
2. the nature and the disposition of the other kinds of iron oxides.

This experiment suggests also that a gentle change of the physicochemical properties of the environment can transform the state of this very small quantity of iron and produce a complete dispersion of the material. It may explain what happened in the toposequence studied by Chauvel (1977) where the red (iron) material was transformed into a yellow one.

We must point out that the presence of oxide involves, for kaolinite-iron oxide systems, the development of a particular structure (Cambier and Prost, 1981). This prompts us to suggest the importance of using natural samples for study because despite considerable progress of late (see section 2.2), our knowledge is not yet sufficient to allow us to reproduce accurately such structures in the laboratory.

c. Aggregation in the presence of organic matter

In a recent work Chassin (1977) has shown that the deposition of humic acids on clays depends on the preparation techniques. Figures 2 and 3 show how humic acids are disposed with respect to the clay fraction in the case of two preparation techniques.

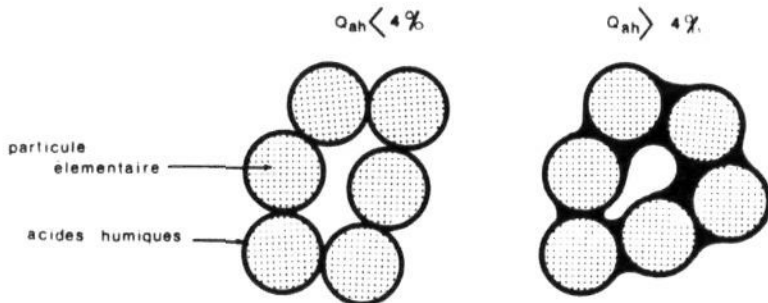


Figure 2 - Disposition of humic acids with respect to the organic matter content Q_{ah} (associations prepared by dehydration).

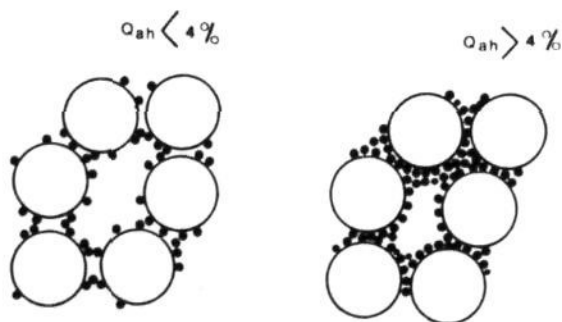


Figure 3 - Disposition of humic acids with respect to the organic matter content Q_{ah} (associations prepared by coflocculation).

In the first the suspension of Ca^{2+} -exchanged montmorillonite and Na^+ -humate is dehydrated at 40°C to give 'associations prepared by dehydration'. For the second technique the suspension of Ca^{2+} -montmorillonite and Na^+ -humate is flocculated by N CaCl_2 . This gives 'associations prepared by coflocculation'.

The proposed formation mechanisms are as follows:

Association prepared by dehydration. Initially where the organic matter is soluble, its absorption on clay is very low. It is distributed throughout the total volume of the liquid phase. During dehydration, organic molecules are concentrated in the remaining liquid phase, and eventually are brought close to the particles, and it is at this stage that the associations between clay and humic acids are formed. Two kinds of bonds can be involved:

1. bonds between clay and organic matter which involve long-range forces;
2. bonds inside the organic matter itself which arise as a consequence of the water removal. This initiates interactions between segments (let us recall that one macromolecule can be described as the succession of n segments). In this case short-range forces are involved.

Association prepared by coflocculation In this case, humic acids and clays are flocculated before the dehydration process; this involves strong interactions between segments. The floccules follow the movement of water, and they are thus located close to the clay particles at the end of the hydration process. As in the previous case, interactions between clay and organic matter may then occur.

These examples, and studies associated with the hydration properties of andosols and humic sandy soils (Chassin *et al.* 1978), show the importance of the disposition of humic substance in the porous media. In the particular case of andosols, it is possible to demonstrate that, for a similar distribution of organic matter, the hydration properties depend upon the spatial configurations (or tertiary structure) of the humic acids macromolecules (Chassin 1979).

Emphasis should be given in the future to understanding the relationship between the macromolecular structures and the physico-chemical properties of the media.

In so far as the transportation of such materials is concerned we should bear in mind that structures can change drastically with varying water contents.

d. Aggregation in the presence of water

Clay materials generally swell in the presence of water. This induces changes in the porosity spectra, and has consequences in the transport properties of the clays. In any case it is very useful to know the dynamics of the porosity as a function of swelling pressure. This implies, of course, a knowledge of the swelling process.

Na^+ -exchanged montmorillonite progressively swells as the water content of the sample increases. The progression is from a powder, to a paste, to a gel, and finally to a sol. The observed spacing between particles for a defined water content corresponds to an equilibrium between repulsive and attractive forces.

In the case of pastes, gels, and sols, we can explain the existence of repulsion forces which bring about the swelling of clay by the presence of a diffuse double layer.

Indeed, the double layer theory accounts in part for the swelling of clay. On the other hand, we attribute the attractive forces to Van Der Waals forces. This hypothesis can account for the sol-gel transition when the water content decreases. Indeed, the layers of Na^+ -exchanged montmorillonite which compose the sol begin to react together to give a face to face orientation once a particular water content has been reached. A gel then appears, and in the end the water content decrease give a turbostratic organization of the montmorillonite layers.

This simple mechanism is no longer valid when sodium is replaced by calcium in the exchange complex, or when montmorillonite is replaced by a smectite in which isomorphous substitution is localized in the tetrahedral sheet of the layer. Indeed, in each case the swelling is limited. This fact can only be explained if we take into account other parameters; for example:

1. the existence of hydrogen bonds between adsorbed water molecules and the oxygen atoms of the siloxane surface when Si^{4+} is replaced by Al^{3+} ;
2. the ability of bivalent cations to satisfy the deficit of negative charge of two adjacent layers.

At the present time there is a good knowledge of clay-water systems when the water content is less than 30%, but there is much to be learned in the case of paste or gel systems. In particular, the attractive and repulsive forces are not well understood in paste or gel systems, and we need a better awareness of the entropic term of the energy.

2.4.3. Additional Remarks on Aggregation and Dispersion of Clay Colloids (Rausell-Colom)

Studies on clay water systems by several workers have dealt with the transition from the crystalline region of swelling, where the water content of the system is low enough for the clay to give a sharp x-ray diffraction pattern, to the so called second region of swelling where, at considerably higher water contents, the clay has the appearance of a gel. This second region is that where diffuse double layers develop and cause surface separations of some hundreds of Angstrom units. Here, x-ray diffraction maxima are broad and indicate a considerable variation of interlayer spacings at any particular water content.

All clays will form pastes upon the addition of water, but swelling to the state where all the silicate layers of each crystallite dissociate and remain separated by long distances has only been observed with montmorillonite saturated with Na, Li, or K in some instances, and with vermiculite saturated with Li and with organic cations such as short chain alkylammonium ions or certain aminoacids.

Research on double layer swelling has used these materials as model systems. Measurements of the swelling pressure at different interlayer separations, as well as of the interlayer separations at different water contents, at different electrolyte concentrations, and with electrolytes of different dielectric constants, have demonstrated that repulsion arising from double layer interaction accounts qualitatively and even semiquantitatively for the swelling behaviour of the clay.

Experiments using macroscopic crystals of vermiculite and polycrystalline aggregates of montmorillonite have revealed that with identical swelling treatments, i.e., same electrolyte concentration and/or externally applied load, the former swell more than the latter. In addition to that, the swelling of vermiculite crystals is reversible while that of microcrystalline montmorillonite exhibits a marked hysteresis. Thus the concept emerges that, in the swelling of the latter, double layer repulsion is opposed by a frictional resistance arising from interparticle bonding. Bonds may result from charges of opposite sign existing on the faces and on the edges of the crystalline plates, or from the action of amorphous oxides, of organic matter, or of any other binding agent present in the clay-water system.

With this model in mind it is obvious that the understanding of the phenomena of particle aggregation and dispersion will benefit in several ways from a better knowledge of the nature and properties of soil colloidal surfaces.

First of all, the ordered structure of the compensating cations and water molecules present in the interlayer space of the clay just prior to double layer disruption should be investigated in every detail. The precise location of the cations and of their coordination water, the transmission of order to the remaining water molecules, the bonds formed between them and with the clay surface, as well as the influence exerted upon that order by the total charge of the particle and its location on the tetrahedral and the octahedral sheets, are factors that, when properly evaluated, could lead to the formulation of precise models for the organisation in the interlayer space from which calculations of lattice energies could be attempted. Then, the factors determining whether the existing order will remain undisturbed or will be spontaneously disrupted into diffuse double layers by the presence of excess water will hopefully emerge.

For the cases where diffuse double layers develop spontaneously the swelling capacity of the clay will depend on the magnitude of the double layer interactions. Many physicochemical parameters govern the distribution of charge and potential for interacting double layers, but the one which is more directly related to the surface properties is probably the specific chemical adsorption potential of the counterions. The specificity of monovalent cations for a particular clay surface should be investigated as a function of the crystallochemical characteristics of the surface, in particular the structural charge and its distribution. Its effect on swelling can be considerable since it determines the fraction of counterions that will remain adsorbed on the surface as a Stern layer. A decrease of the swelling pressure by a factor of 3–10 may be expected for a system where the specific chemical adsorption potential amounts to 6 KJ.

2.4.4. Conclusion (Prost)

The examples given show that it is difficult to deal with the problem of aggregation by taking into account only short distance forces. It would appear to us that the *cohesion* of a soil aggregate is a combination of both long and short range forces. Nevertheless, it is important to distinguish these two kinds of forces. Indeed, the *behaviour* of the sample is governed by the type of force which is operating. Let us consider, for example, the cases of sodium-exchanged montmorillonite and vermiculite clays. The Na⁺-montmorillonite has an unlimited swelling whilst that of vermiculite is limited. We believe that the differences in the swelling properties are due to the existence of different kinds of forces in the two samples. Long-range forces are probably involved in the case of montmorillonite, and short-range forces are more likely to operate in the case of vermiculite.

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2.5. Microbial Activity at Soil Colloid Surfaces

R. G. BURNS¹)

2.5.1. Introduction

Much of the basic knowledge of microbial functions in soil is derived from experiments using mm^3 and cm^3 quantities. In other words, what is being assessed is the sum of an enormous number of extremely diverse biological events. Unfortunately this effectively obscures the behaviour of individual or small colonies of microbes, for they perform their activities within zones whose boundaries are measured, not in mm and cm, but in μm and nm. In an axenic culture, exposed to an abundant, homogenised, and easily-assimilable source of nutrients and maintained at the appropriate pH and temperature (e.g. in a chemostat), it may be true that all viable microbes are performing the same transformations at approximately the same rate within the same environment. In soil, however, the very opposite applies. Here a genetically-diverse population is competing for a small quantity of unevenly distributed (both in time and space) substrate and is subject to micro-environment variations and fluctuations in pH, redox potential, ionic concentration and level of hydration. In addition, microbe-microbe, microbe-plant, and microbe-animal interactions create unique locales as do the physical barriers erected by inorganic particles, either individually or as components of aggregates.

In the past ten years significant inroads have been made towards understanding the actual microenvironment in which the soil microbe resides (Stotzky, 1974, 1980; Hattori and Hattori, 1976; Marshall, 1976; Burns, 1979, 1980). What emerges quite unambiguously is that the physical and chemical properties of soil clays and humic materials have a profound influence upon micro-organisms in their vicinity and that it is principally due to two characteristics, namely their high surface to volume ratios and their ionic properties. Consequently, microorganisms, substrates, enzymes, metabolic and transformation products, inorganic ions and water molecules tend to be concentrated, and therefore to interact, at the soil colloid/liquid interface.

Once these general observations are accepted it is incumbent upon the soil microbiologist to bring about the marriage of various disciplines (e.g. enzymology, colloid science, mineralogy, microbial physiology and metabolism) in order to better understand microbial activity within the soil microenvironment.

2.5.2. The Soil Micro-Environment

The soil micro-environment principally consists of:

- (i) inorganic particulates, especially sand, silt, clay (Section 2.1), and certain oxides and hydrous oxides (Section 2.2) which may be intimately associated with other soil colloids such as humic matter;
- (ii) a chemically-diverse organic fraction;
- (iii) an aqueous phase containing unevenly distributed organic and inorganic moieties;
- (iv) a gaseous phase differing significantly from the atmosphere in which we live. For instance, the respiratory activity of microorganisms can increase CO_2 levels 100-fold in the soil, O_2 contents can fluctuate widely, as can the levels of methane, ethylene, H_2 , H_2S , and the various gaseous forms of nitrogen.
- (v) the microbiota.

The soil clays are generally regarded as the most important of the inorganic constituents as far as their influence on biological activity. This may be attributed, for the most part, to their extensive surface areas and their ion-exchange properties. Model clays have specific surface areas ranging from $<20 \text{ m}^2 \text{ g}^{-1}$ for kaolinite to over $750 \text{ m}^2 \text{ g}^{-1}$ for 2:1 expanding layer clays, and the cation exchange capacity can range from <50 , to about 1000, and to as much as $2000 \mu\text{eq g}^{-1}$ for kaolinites, smectites, and some vermiculites, respectively. Soil clays may contain some such model-type structures, but in many instances the surface properties of these complex structures cannot be represented accurately by composites of the properties of model clays (Section 2.1).

The influence of the clay colloid on the adsorption processes which take place at the clay-water interface declines exponentially with distance of adsorptive from the clay surface. Talibudeen (1981) and Mott (1981) have given relevant treatments of ion-exchange processes at soil and clay surfaces, and Arnold (1978) has presented an appropriate treatment of the *diffuse* or *electrochemical double layer* (DDL) describing the zone containing accumulated cations and the corresponding deficit of anions.

Although silt, and sand components in particular, help to separate the soil inorganic colloids, and thereby help promote diffusion of gases and water, they have little influence in retaining water and nutrients. Only in rare circumstances (Wiese and Rheinheimer, 1978) do sand and silt attract and support any significant proportion of the indigenous microbial population, and they accumulate colloidal organic matter only to a limited extent (Ladd *et al.*, 1977; Tate and Churchman, 1978).

Soil organic matter consists of three discernible fractions which may be described as:

- (a) debris resulting from the early stages of breakdown of plant, animal and microbial remains;
- (b) breakdown products which are biochemically well-defined (e.g. polysaccharides, polypeptides, organic acids); and
- (c) amorphous, brown, colloidal humic polymers which bear no morphological resemblance to any parent materials from which they may have been derived, and which may be fractionated on the basis of their solu-

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bilities in aqueous acids and bases into humic acids, fulvic acids and humin materials (see Section 2.3).

As a result of its heterogeneity soil organic matter includes a wide range of substrates, varying in ease of breakdown from soluble sugars to phenolic compounds that are actually bacteriostatic. Overall, the humic fraction would appear to be at a steady state in an undisturbed soil; Jenkinson (1971), suggests that its slow decay (2–5% per annum) is counteracted by the humifying effects of the microflora.

Section 2.3.1. describes concepts of the structures (including shapes) of humic polymers. Their flexible polyelectrolyte properties are very relevant in the context of this paper, because the polymers can expand on hydration to reveal an extensive internal surface estimated to be in the range of 500–800 m² g⁻¹, although this estimate would appear to be conservative. Carboxyl and phenolic groups contribute most to the CEC of soil organic matter which can range, depending on composition, pH, and other factors from 2000–5000 $\mu\text{eq g}^{-1}$, and is of the order of 4000–5000 and 5000–7000 $\mu\text{eq g}^{-1}$ for the humic acid and the less abundant fulvic acid components, respectively. Soil organic matter which contains organic bases (particularly amino groups) will have an anion exchange capacity which is pH dependent.

Individual bacterial cells are of colloidal dimensions and have ionogenic properties determined by the isoelectric points of their outermost wall constituents. The nature and distribution of this charge may be revealed by measuring the electrophoretic mobility of the cells, observing bacteriophage attachment, and by using serum antibodies. Gram-positive bacteria cell walls composed of peptidoglycans, lipids and teichoic acids, with anionic teichoic acid polyelectrolytes concentrated towards the outer surface of the cell. The electronegativity of these polymers is determined by phosphate ester groupings, alanine ester residues, and is influenced by the ambient pH and possibly by conformational changes in the wall components (Archibald *et al.*, 1973). Lipoproteins, capsular proteins, and enzymes are the major components of the outer membrane of Gram-negative bacteria. These proteins induce net negative, net positive, or a balance of positive and negative charges at the surface, depending on the pH of the environment (Marshall, 1976, p. 8–10). Lipopolysaccharides should also have a profound influence on the cell's overall charge and adhesive properties.

There is little information about the ionogenic organization of fungal cell wall constituents – glucans, cellulose, chitin, chitosans, etc. – although the presence in some groups of aminopolysaccharides, polyuronides, and proteins implies that these should have ionogenic properties similar to those of bacteria.

The soil components *in situ* should not be regarded as a collection of discrete components such as those described above. Clays are generally flocculated in domains, and the assemblage of associated clays, oxides, and organic components, as well as the silt, sand, and microbiota produce the aggregates so essential to soil fertility. It is clear that within these macro-structures (0.5–5 mm) the chemical and physical effects of the component micro-environments are modified.

Burns (1980) has reviewed some of the other properties of soil components *in situ* which should be taken into account when considering microbial activity at soil colloid surfaces. These include considerations of:

- (a) the distribution of ions within the diffuse double layer;
- (b) the predominantly negative charges of the clay, humic and microbial components at ambient soil pH values, and the necessity of the microorganism to overcome the resultant potential energy barrier before it can establish intimate contact with the surface of the soil colloid. Consideration is also given to the concentration, along with other cations, of H⁺ ions within the DDL which might influence the sign of the charge, depending on the nature of the functional groups on the adsorbents and adsorptives. (See also Stotzky, 1980).
- (c) the possibility that the microorganism might have the capability to change its own environment, and thus its ionic properties.
- (d) the possibility that microbes may tenaciously adhere to surfaces by way of exopolymers, flagella, and prostheca;
- (e) the properties of water at the adsorbent surfaces and its influence on adsorption processes.
- (f) the influence of gases on the microbial activity; for example, as the result of poor oxygen solubility, anaerobiosis is rapidly established following the rapid assimilation of substrate by aerobic heterotrophs. Because oxygen cannot be supplied fast enough the environment becomes more suited to anaerobes, and these bacteria will in turn induce further changes in the soil atmosphere by producing gases such as methane and nitric oxide.

2.5.3. Effects of Soil Surfaces on Microbial Growth

There are now several reports of experiments which have measured the change in growth rate and yield of microorganisms following the addition of soil organic and inorganic fractions to the nutrient medium. Burns (1980) and Stotzky and Burns (1982) have presented a few representative examples of these studies.

Montmorillonite produced the most dramatic stimulation in the production of humic type materials when three fungal species were incubated in glucose media containing this clay, kaolinite, and vermiculite (Bondietti *et al.*, 1971). Later experiments by Filip *et al.*, (1972) showed that it was essential to have the media well aerated in order to optimise production of humic substances: poorly aerated cultures were either unaffected or even inhibited by clay additions. Filip's work demonstrated that the same effects could be produced by enclosing the clays in dialysis tubing, thereby isolating the crystallites from the microorganisms, indicating that contact between clay and organisms was not necessary, and possibly suggesting that the clays adsorbed potentially toxic metabolites. Work by Martin *et al.* (1976) has shown that Ca²⁺-

montmorillonite and humic acid materials, separated in dialysis tubing from actinomycetes in an incubation medium, stimulated growth of the microorganisms. This again focuses attention on the possible adsorption of toxic metabolites although the authors considered that stimulatory organic molecules might be supplied by the clay.

Reports related to soil-pesticide interactions give numerous examples of microbial inhibition and stimulation related to adsorption (Burns, 1975), especially for substituted ureas *s*-triazines, bipyridyls and phenoxycarboxylic acids. Interestingly the availability and subsequent persistence of some pesticides, notably the acylanilide herbicides (Hsu and Bartha, 1976), is affected by the incorporation of partial breakdown products into humus.

Descriptions of the effects of clay additions on the microbial degradation of various naturally occurring organic substrates may be found in reviews by Stotzky, 1974, 1980 and Marshall (1976). Table 1 provides a list of some stimulation and inhibitory effects on decay and/or microbial growth of a number of colloid surface phenomena.

2.5.4. Extracellular Enzymes and Substrates at Colloid Surfaces

Enzymes in soil, once released from their parent cells, must avoid adsorption, degradation, and denaturation if they are to be successful in their quest for a substrate. They are faced with problems not normally encountered by their counterparts *in vitro*. For example, suitable substrates in soil are unevenly distributed and will vary in their concentration with time. When an enzyme finds a substrate at least a proportion of the product must survive long enough to be utilized by the microorganism which produced the enzyme in the first place. The problem is compounded if the substrate is insoluble (either by dint of its molecular size or because it is adsorbed) and by interspecific competition for soluble product.

The available evidence strongly indicates that free enzymes do not survive for long after externalization and that their principal mechanism of resisting destruction is to become associated with the organo-mineral complex. The resulting persistent or 'accumulated' enzyme fraction is responsible for a significant volume of extracellular substrate turnover. Accumulated enzymes originate from both extant and extinct cells, are not exclusively extracellular in normal function (e.g. urease, arylsulphatase), and are predominantly hydrolases and oxidoreductases. The properties and significance of some fifty soil enzymes have been reviewed extensively (Burns, 1978).

Table 1. *Some possible effects of soil colloids on substrate decay and microbial growth.*

Colloid surface phenomenon	Effect on substrate decay and/or microbial growth (relative to that in absence of clay-humic colloid)
uxtropes microbe (or enzyme) and substrate	stimulation
orientates enzyme beneficially relative to substrate	stimulation
functions as buffer during metabolism	stimulation
adsorbs inhibitory metabolites	stimulation
retains H ₂ O film-prevents desiccation	stimulation
concentrates inorganic nutrients	stimulation
induces proton gradients-facilitating nutrient transport	stimulation
protects microbes from predators	stimulation
supplies soluble substrate (humic-enzyme complex)	stimulation
adjusts C: N ratios (humic colloid)	stimulation
allows co-metabolism of adsorbate (humic colloid)	stimulation
performs abiological delay in a biological sequence	stimulation
adsorbs microbe (or enzyme) distant from substrate	inhibition
intercalates substrate-inaccessible to microbe (clay colloid)	inhibition
incorporates substrate into humic polymer - inherited resistance	inhibition
inactivates enzymes due to structural changes	inhibition
masks active site of enzyme	inhibition
entraps microbe in colloidal aggregate - limited O ₂ , nutrients	inhibition

It appears that accumulated enzymes are complexed with organic colloids in such a way that proteolysis is avoided whilst activity is retained. Active humic-enzyme fractions have been extracted from soil (Getzin and Rosefield, 1971; Burns *et al.*, 1972a; Mayaudon *et al.*, 1973; Cacco and Maggioni 1976; Pettit *et al.*, 1976) but further purification has proved elusive. The true nature of the enzyme-humic association is in some doubt, although physical entrapment (Burns *et al.*, 1972b), ionic, covalent, and hydrogen bonding (Ladd and Butler, 1975) and incorporation into the humic molecule as it is formed (Rowell *et al.*, 1973) have all been proposed. An attempt has been made to mimic this final mechanism by successfully synthesising an artificial 18-component polyphenol (using tyrosinase) of which urease is an integral and permanent part (Burns and Martin, unpublished data).

Notwithstanding, enzymes are also adsorbed to clay particles and there is an extensive literature describing this phenomenon (McLaren and Packer, 1970; Theng, 1979). Many questions remain as to the residual efficiency of clay-adsorbed enzymes, their susceptibility to proteolysis (see Stotzky, 1974), and indeed the relevance of these studies to *in situ* soil conditions. Because of hydrogen ion concentration within the DDL, sorbed enzymes tend to have higher pH-activity optima than in the absence of soil (McLaren and Skujins, 1968).

Mortland (1970) and Burchill *et al.*, (1981) among others have reviewed mechanisms of adsorption at clay surfaces. Burchill *et al.* (1981) and Theng (1979) have considered some detail of the adsorption of polymers by clays and the former group has outlined some mechanisms by which small organic molecules (*pesticides are bound to humic colloids. Although it is difficult to accurately assess the extent and the nature of substrate adsorption in soil, there are a number of trends which emerge from a study of the literature. Of relevance in the context of this position paper is the fact that amino acids are adsorbed as cations by montmorillonite, and proteins are adsorbed at the edges and between the layers of smectites, but to varying extents depending on the molecular weight of the adsorptive, the ionized or ionizable functional groups present, the valency of the resident inorganic cation, etc. (see also Stotzky, 1980). Anionic nucleic acids are also adsorbed, possibly by way of polyvalent inorganic cation bridges to the clay surface. Monosaccharides are adsorbed only at relatively high concentrations, whereas, depending on their solution conformations, polysaccharides can be extensively adsorbed (Burchill *et al.*, 1981).*

2.5.5. The Microbial Micro-environment

A microbial cell adhering to a colloid surface will be at least partially immersed in a dense cloud of inorganic and organic ions. These will largely be concentrated by adsorption forces at the colloid-solution interface, although the microorganism itself will both attract and excrete ions. In theory, there should be substantial nutritional advantages to a microorganism residing in this environment. For instance, a lithotrophic bacterium, such as a *Nitrosomonas sp.*, relying on inorganic cations for energy and nitrogen would be particularly advantaged in a DDL high in ammonium ions. Similarly, heterotrophs utilizing cationic organic moieties would benefit. Realistically, however, the availability of these potential nutrients is determined by a large number of inter-related factors, such as valency of ion, molecular size and structure of organic substrate, tenacity of adsorption to the colloid, together with the electrochemical and transport properties of the microbe itself and its production of exchangeable H^+ . One might even hypothesise that the proton gradients between the adsorbed cell and the adsorbant aid substrate uptake (c.f. intracellular chemiosmosis).

A microorganism in close proximity to the organic colloid is likely to be exposed to the products of accumulated enzyme activities. Indeed, this may emerge as the ecological function of this colloid-bound catalytic fraction, in that it provides soluble substrates for microbes which would otherwise have to excrete enzymes themselves (Burns, 1982). Moreover, soluble molecule B (Figure 4), resulting from the activity

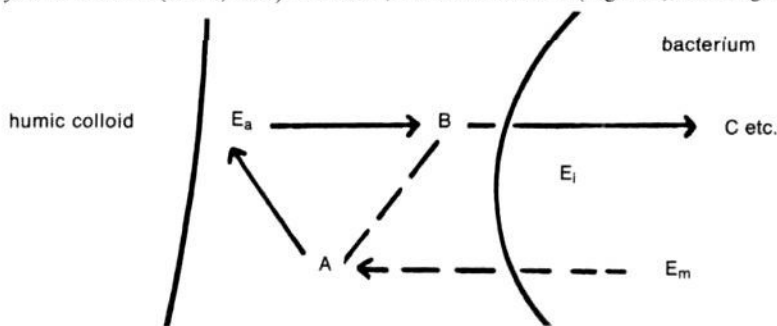


Figure 4. Conceptual role of accumulated enzymes in soil microbial ecology

of accumulated enzyme E_a , may be further degraded by intracellular enzyme (E_i) and serve as an inducer when substrate, A (and therefore product B or C) levels are high enough. Under these circumstances the microbe may excrete enzyme, E_m , and assume the dominant role in exogenous substrate decay. This system may have evolved in soil in order to avoid continuous and wasteful production of exoenzymes which would have great difficulty in surviving long enough to find a substrate. One obvious beneficiary of this type of relationship is the genus *Nitrosomonas*. This bacterium may utilize the products of neighbouring accumulated urease, although, in this example, it may never assume a ureolytic role itself.

Microorganisms have a reciprocal relationship with their microenvironment and are capable of bringing about some major changes during metabolism, many related to the production of organic and inorganic acids and nutrient solubilization and chelation. Finally, local concentrations of inorganic ions may influence cell membrane composition, permeability, and integrity as well as toxin production, spore formation, and bacteriophage attachment.

2.5.6. Effects of Soil Colloid-Microbial Interactions on the Physical Properties of Soils

There is plenty of evidence to indicate that microbial polysaccharides play an important role in stabilizing soil aggregates (Burns, 1977; Hayes and Swift, 1978; Theng, 1978; Cheshire, 1979; Burchill *et al.*, 1981), as do the humic polymers (Griffiths and Burns, 1972; Theng, 1979; Burchill *et al.*, 1981). It is plausible to consider that polysaccharide and polyphenolic polymers synthesized adjacent to inorganic colloid surfaces would attach themselves to these surfaces (assuming of course that the conditions for adsorption were appropriate) and initiate soil aggregate formation and stabilization. There is some evidence to suggest that fungal hyphae can mechanically bind soil aggregates (Aspiras *et al.*, 1971; Forster and Nicolson, 1981).

2.5.7. Areas where Research is needed

It is convenient to regard the soil and its microbial inhabitants as components of a dense colloidal suspension. It then follows that microorganisms are subject to all the chemical and physical properties of that type of environment. Thus, in order to increase our understanding of soil microbiology we should be prepared to investigate this colloidal world and to theorize as to the true nature of the bacterial and fungal microenvironment. This fundamental approach has been the subject of several reviews in recent years (McLaren and Skujins, 1968; Filip, 1973; Hattori and Hattori, 1976; Stotzky, 1974; Marshall, 1976; Burns, 1979).

Among the many fundamental problems which need attention are:

1. Investigations of the detailed mechanisms by which microorganisms, enzymes, and substrates are held at colloid surface. The approach should seek details of the extents, reversibilities, and energetics of the adsorption processes.
2. Experiments designed to reveal the changing nature of surface interactions with time – especially in relation to shifts in pH, ionic concentration and type, and organic nutrient levels.
3. Studies of the location and activities of colloid-associated enzymes, together with the reactions which incorporate them into humic polymers and impart persistence.
4. Projects directed towards revealing the consequences of microbial association with surfaces and concentrating on the following:
 - (a) the availability of organic substrates to microorganisms when one or both are in the adsorbed state;
 - (b) the importance of inorganic ions within the diffuse double layer to autotrophs (especially *Nitrobacter* and *Nitrosomonas species*) and heterotrophs;
 - (c) the extent of the Δ pH between the intracellular environment of the adsorbed microbe and its point of contact with a colloid surface and whether this gradient has any effect upon nutrient uptake;
 - (d) the factors which influence the movement of microbes from one surface to another (e.g. chemotaxis) especially as they refer to the location and metabolism of substrates.

2.5.8. Summary

Microbial activity in soil occurs at, or in close proximity to, clay and humic surfaces. Therefore it is not surprising that the physico-chemical properties of these soil colloids have a profound effect on microbial growth and substrate utilization. Consequently our understanding of microbial activity in soil (and ultimately its relationship to agriculture and the environment) is determined by our ability to investigate the micro-environment of the soil microorganism.

The areas of research identified here may require the development of new techniques or the adaptation of established ones. Whatever, the intention is that they should stimulate investigations which will lead to a greater comprehension of the complex environment of the soil.

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2.6. On the Interaction between Solid and Liquid Phase in Soil, Emphasizing the Use of Models.

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2.6.1. Introduction

The functioning of soil as a substrate for plant growth depends critically on the progression of various transport and accumulation processes. In turn these processes are the outcome of the interactions between solid and liquid phases. Knowledge about these interactions thus stands at the base of the understanding of several subdisciplines of soil science, as e.g. soil genesis, soil fertility, soil pollution studies, and it forms the hard core of soil chemistry. Incomplete knowledge of the interaction processes between the different phases of soil is often a limiting factor when striving towards optimal usage of soil as a production factor (viz. quantitatively and qualitatively for maximal production of a crop).

The interactions between liquid and solid phases in soil encompass numerous and complex processes. In order to assess the peculiar role of the many different factors involved one must disassemble these processes. Conversely, reassembly is necessary if the integral view needed for predictive purpose is sought. These two actions, disassembling and reassembling, together may be termed 'modelling' processes.

In the following review some remarks will be made about types of models and their uses in Soil Chemistry. An attempt will be made to assess roughly the state of the art with respect of available information on particular building stones (like material properties and subprocesses), and the reader is referred to the other contributions in this series of position papers for more detail.

2.6.2. Types and Uses of Models in Soil Chemistry

At the outset it is of help to distinguish between types of models. Thus a distinction may be made between the static models which describe material properties (in a given state) in particular, and dynamic models which describe processes. A second distinction may be made along the line of simple (in the sense of single feature) models versus composite models. Finally the distinction is made between qualitative and quantitative models and also between behavioral and theoretical models.

The reason for making the above multiple division (which could be augmented) lies in the need for a warning system when applying a particular model. The model which is used must be relevant to the problem which needs to be solved. Actually, in order to make satisfactory predictions with respect to the chemical behavior of soil under foreseen circumstances one always strives towards using a quantitative, theoretical model covering a composite process. It is the last adjective in particular which makes the goal practically unattainable. A composite process, if fully understood, implies knowing all underlying 'single feature' processes in terms of quantitative, theoretical models, as well as knowing the static models characterizing the materials involved.

Before the introduction of the computer, complete and quantitative knowledge of all underlying processes would still not suffice to construct and solve a composite model. Now, in fact, the opposite situation has arisen, where the relative ease of computer simulation has enticed many to construct composite models based on strictly behavioral models of subprocesses (and sometimes on fantasy). The inherent weakness of such a procedure is quite obvious. Indicating the behavioral model with the term 'black box' model, it appears that the lack of understanding of why a certain subprocess gives rise to the observed relationships between certain parameters, poses the threat that this observed behavior is subject to uncontrolled conditions which may not apply in the composite process studied.

Computer simulation can be a great asset in view of the impossibility of knowing all subprocesses quantitatively. Starting with only semiquantitative or with only qualitative knowledge of subprocesses, the computer simulated composite model is of considerable help in assessing the relative importance of such subprocesses and of the system parameters involved. Such a sensitivity analysis then indicates which properties or parameters are of critical concern, guiding one to study those in favor of others. The weakest link in a network of processes is not necessarily the one that is least accurately known! The ensuing composite models, based on partial understanding only of the subprocesses involved, could be termed grey-box models, which may well be the best one could hope to deliver in order to predict behavior in soils under field conditions. One example may elucidate the above. Given the envisaged use of soil for the disposal of waste water containing considerable amount of phosphate, the question arises 'how much and at what rate' could (the water) be applied before the penetration of undesirable levels of P in solution exceeds a certain depth. Recognition of the presence of fast-loading and slow-loading pools allows one to construct a composite model, containing empirically determined field behavior under conditions related to those prevailing when determining the empirical factors mentioned. The soil with its pools then constitutes a 'grey-box', that is, one accepts a plausible behaviour based on e.g. the quantitative verifiable presence of Al and/or Fe compounds as P-binders, without knowing the precise nature of the binding mechanisms. Obviously, the more one understands about the latter as well as other features, like e.g. dispersion effects in field columns, the better are the changes for extrapolation to conditions differing substantially from the ones studied initially. The shade of grey of a composite model thus depends on the quality of the submodels serving as building stones.

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2.6.3. Building Stones of Models in Soil Chemistry

a. Nature of solid phase components

The interaction processes between solid and liquid phases may be summarized as solubilization and adsorption processes. The relation between solubility and solid phase composition is a complex problem, at least in a natural system like soil where ideal crystalline phases are the exception rather than the rule. With the advance of refined analytical techniques and tools, this problem is receiving increasing attention from soil- and geochemists. Much information is still lacking in this field.

Focusing attention on the properties of adsorbents, it is clear that components with high specific surface areas must be considered, and in particular those with a high surface density of charge. In these contexts the clay minerals, (hydr)oxides and organic matter are of particular importance. Attention is given in Sections 2.1, 2.2, and 2.3 to the state of knowledge with respect to these components. It may be concluded that much needs to be learned about the structural properties of the solid phase constituents of soil, and our present knowledge is very deficient in so far as predicting adsorption at the soil solid-liquid interface is concerned.

b. Adsorption properties of the solid phase

Numerous publications have appeared in the soils literature which contain experimental information on the adsorption properties of the solid phase. The fact that the theoretical insight into the nature of adsorption processes has not kept pace with the account of experimental information gathered may undoubtedly be traced to the complexity of the problems encountered (in the often ill-defined systems). Equally so, however, a lack of coordination between the researchers involved has played a role here.

Before attempting to sketch in a fairly superficial manner the state of knowledge on the adsorption properties of clay minerals, (hydr)-oxides, and organic matter, it is pointed out here that certain new developments in agricultural practices (use of pesticides, applications to land of wastes from bioindustries, and the use of land sanitary fills, etc.), as well as increasing fall out from air pollution from industrial activities, emphasize the need for detailed information about adsorption processes in soils. Indeed optimization of soil for production is often limited because of the lack of information about its interaction with (sometimes large amounts of) additives which are foreign to soil.

Clay minerals. Many of the models used for the description of the adsorption of cations in macro-amounts by soil constituents are based on studies of suspensions of 'pure' clays often obtained from mined sources, (cf. Section 2.1). In general the configuration of such cations in the form of a double layer distribution seems acceptable, albeit that a large share of at least the di- and polyvalent cations will be stored in a condensed double layer formed between clay-plate condensates or domains. Predictions with regard to cation-selectivity coefficients, based on material characteristics, are difficult; usually they are determined empirically and then reasonably reproducibly, though in cases subject to hysteresis. Nevertheless, a semi-quantitative understanding seems possible of the effects of cationic valence (for the regular cations present in large amounts) and of clay charge density. In the case of dilute suspensions of the extensively used montmorillonite, particularly when it contains a large percentage of monovalent cations, a striking verification of the presence of diffuse double layers is possible. This possibly constitutes the closest approach between a theoretical model, from colloid chemistry, and the behavior of a soil constituent, albeit under conditions seldom met in the field. Nevertheless, these observations provide a starting point for a semi-quantitative interpretation of the behaviour of sodic soils in nature.

Usually it is difficult, if not impossible to predict the adsorption of cations by a soil of a given clay-mineralogical composition. In part this is caused by the fact that the clay minerals present are ill-defined. It is equally probable, however, that clay minerals contain surface coatings (hydr)oxides that may influence the adsorption properties. Such coatings are being increasingly studied. Thus the insight into the significance of coatings with respect to the adsorption properties of soil is growing. This is particularly true with respect to transition metal behavior. The present state of knowledge is, however, rather limited, but hopefully this will improve significantly in the near future.

The possible use of the synergistic action of added organic ligands, as suggested recently, is of great interest. Even temporary immobilization would be of help in the case of calamities.

A general problem (also met with the other 'building stones') is to extrapolate results determined at laboratory conditions to field situations. Here (as an example) the lack of verification under conditions of low (field) moisture contents of the experimentally determined selectivity coefficients could play a role. It seems likely, though, that the effect of deviations from the values of selectivity coefficients as found in dilute suspensions is minor in comparison with deviations from exchange equilibrium due to diffusion resistances in thin water films.

(Hydr)oxides. While the knowledge of the adsorption processes of ions onto clays minerals is already far from complete, the elucidation of such processes involving (hydr)oxides is much poorer. Only relatively minor efforts have been made to describe quantitatively the behavior of a surface governed by potential determining H-ions and subject to specific adsorption of many divalent cations (causing a shift of the PZC). No doubt an interesting and rewarding attempt could be made to approach somewhat more closely

the type of characterization of (e.g.) AgI surfaces, as provided by colloid chemists. In this context the use of NH₄-acetate to determine the CEC of oxisols, as suggested in Soil Taxonomy, offers challenge for improvement.

Equally interesting are further efforts to quantify the interaction between oxides and phosphate ions. Though known broadly as a type of ligand exchange, a further investigation specifying, amongst others, differences between Al and Fe(III) (hydr)oxides and competitive effects, would be of great interest, both with regard to phosphate management in many tropical soils and in relation to P-immobilization in cases of excess supply from waste sources. The 'old' knowledge of the slow formation of crystalline P-compounds after initial adsorption on, for example, oxides deserves further investigation in this respect.

The above mentioned (hydr)oxides themselves, whether present separately or as coatings, also need considerably more attention than they have received in the last decennia. Granted that the X-ray identifiable part of these tends to have a low specific surface area, the amorphous parts will be of particular importance with respect of phosphate and transition metal binding in soils, and this not only in tropical oxisols.

Organic constituents. It is clear that the extensive information on functional groups of soil organic constituents is not quite matched by the information available about their cation binding properties. The difficulty of obtaining organic compounds with satisfactory chemical stabilities is no doubt a limiting factor here.

Only comparatively scant information is available on the interaction between cations and organic constituents. That is, the complexing tendency towards certain di- and tri-valent cations is well-known, but it is still difficult to guess on stability constants applicable to mixtures of cations present in a given soil. Obviously, degradation of complexes formed should also be studied if long term predictions are needed.

The liquid phase. The above largely concerns some existing static, single feature models of partly (semi)-quantitative nature, with (at least some) theoretical background. In this context the investigations on solubility equilibria in soil could also be mentioned. For an identified chemical compound in a known solvent, thermodynamics predicts the existence of certain relations between the activities of the dissolving fragments, leaving one, or more, constants to be determined experimentally. The procedure in the opposite direction, i.e. concluding about the existence of certain compounds on the basis of observed activity relations, is much more speculative. In complex mixtures, like a soil solution, an observed relation between the activities of certain ions should be classified as a behavioral model of the system. Though probably quite useful, great care must be exercised when extrapolating beyond the range of experimental observations available.

c. Solid-liquid phase interaction subject to a moving liquid phase

Extension to solute movement in soil columns brings one directly into the realm of the composite dynamic model, because the flow pattern of the liquid phase also comes into the picture. Because of the central position of the solute movement in the broader context of transport and accumulation phenomena of solutes in soils, these processes have received considerable attention, and they have been referred to as miscible displacement and (exchange) adsorption chromatography. The simplest experiments, done with saturated leaching through homogeneous laboratory columns, have contributed considerably to the understanding of the main features comprising retardation of the solute as a function of its adsorption isotherm. This however is confounded with dispersive features caused by longitudinal (column) diffusion, and convective dispersion proper complemented by transversal diffusion between regions with different flow velocities. While the theory underlying the separate phenomena appears plausible, the foregone conclusion that the breakthrough of a solute front tends to have a distorted S-shape, makes unambiguous interpretation of the latter in terms of parameters characterizing the component processes difficult. Extending to fieldcolumn behavior with a varying moisture content and an oscillating carrier flux, brings one of necessity to computer simulated grey-box models. Sensitivity analysis on the basis of expected ranges of parameters involved, plus an open eye for macro geometry, should help to make the appropriate choice of the model to be used. Adding the possibilities of degradation of the solute (e.g. pesticide), and long term precipitation reactions (e.g. phosphate) to three dimensional variability of soil in the field, it is clear that quite different models could be preferable for different purposes.

2.6.4. Conclusions

Restating part of the goal of soil chemistry as the prediction of accumulation and the transport of mobile compounds in the field, one finds the need for:

- a. describing the nature of the (contaminated) surfaces of the solid phase and the composition (and mobility) of the liquid phase;
- b. studying their interactions with compounds to be added, including the reversibility, and the rates of such reactions;
- c. verifying the accessibility of the surfaces under field conditions; and
- d. mounting this information in appropriate simulation models.

Clearly, meeting the goals listed above would benefit greatly from mutual cooperation between those involved. Letting fantasy run wild for a moment, one could envisage actively soliciting each other's help

in selecting the best submodels for mounting in a composite model designed to solve a given (usually practical) problem, with some appropriate body of Commission II acting as a clearing house. Briefly, this would amount to stating one's problem in terms of a proto-type composite model, and specifying the sub-processes presumably involved. At that stage comments would be of value, both with regard to the appropriateness of the prototype model, and concerning the existing know-how about subprocesses involved. Next one might design his programme of attack, i.e. what parameters should still be determined by which methods, hopefully in some cases leading to active cooperation of those best equipped for the purpose, and in other cases enabling one to skip time-consuming experiments. The final stage, i.e. the construction of the composite model, obviously also involves specialised know-how, and cooperation at that stage may again prove invaluable.

Returning to reality, one must face the fact that most scientists are used to (attempt to) solve their problems within their own groups and then publish. If time permits they read about each other's efforts and thus 'cooperate', though somewhat belatedly and in an impersonal manner. Given the time delay involved in this type of cooperation, however, the above fantasy, implying a type of prenatal care of projects to be started, might be worth considering. Clearly, care must be exercised that appropriate acknowledgement of help received in early stages is given, and this is one reason why it may be sensible to involve a clearing house a suggested.

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 2. Talajtani Társaság/Hungarian Soil Science Society
 3. I. Szabolcs; F. Jassó
 4. Research Institute for Soil Science, Herman 0.u. 15, Budapest II, 1022 Hungary
 5. 820 (31); Ft. 50
 6. Agrokémia és Talajtan (2); Ft. 80
1. **India - Inde - Indien**
 2. Indian Society of Soil Science
 3. N. S. Randhawa; A. B. Ghosh
 4. c/o Division of Soil Science & Agricultural Chemistry, Indian Agricultural Research Institute, New Delhi 110012, India
 5. 820 (175); Re. 20
 6. a. Journal of the Indian Society of Soil Science (4); US \$ 10
b. Bulletin of the Indian Society of Soil Science (occasional)
1. **Indonesia - Indonésie - Indonesien**
 2. Himpunan Ilmu Tanah Indonesia
 3. M. Soegiman; J. Soedarsono
 4. Departemen Ilmu Tanah, Fakultas, Pertanian UGM, Yogyakarta, Indonesia
 5. 220 (27); Rp. 4.000
 6. Newsletters (2-3); Bulletins, Proceedings (occasional)
1. **Iran**
 2. Soil Science Society of Iran
 3. M. A. Massoumi; A. A. Salardini
 4. Soil Science Department, University of Teheran, Karadji, Iran
 5. - (55); -
 6. -
1. **Ireland - Irlande - Irland**
 2. Soil Science Society of Ireland
 3. M. J. Gardiner; J. Collins
 4. Faculty of Agriculture, University College, Belfield, Dublin 4, Ireland
 5. 40 (38); -
 6. -
1. **Israel - Israël - Israel**
 2. Ha'aguda Lemada'ey Hakarka Be'Israel/Israel Society of Soil Science
 3. I. Ravina; J. Halevy
 4. Inst. Soils and Water, A.R.O., Volcani Center, POB 6, Bet Dagan 50-200, Israel
 5. 115 (97); IS 15
 6. Newsletter of the Israel Society of Soil Science (3-4)
1. **Italy - Italie - Italien**
 2. Società Italiana della Scienza del Suolo/Italian Society of Soil Science
 3. G. Florenzano; R. Materassi
 4. Istituto di Microbiologia, Agraria e Tecnica, Piazzale delle Cascine 27, 50144 Firenze, Italy
 5. 248 (187); Lit. 4000
 6. Bollettino della Società Italiana della Scienza del Suolo
1. **Japan - Japon - Japan**
 2. Nippon Dojohirjo Gakkai/Japanese Society Soil Science and Plant Nutrition
 3. A. Tanaka; T. Kaneko
 4. 26-10-202, Hongo 6-chome, Bunkyo-ku, Tokyo, 113 Japan
 5. 2089 (219); ¥ 6.000
 6. a. Nippon Dojohiryogaku Zasshi (Japanese Journal of Soil Science and Plant Nutrition), (6); ¥ 1600 per copy
b. Soil Science and Plant Nutrition, (4); US \$ 11.50 per copy, incl. mailing

1. **South Korea - Corée du Sud - Südkorea**
2. Korean Society of Soil Science and Fertilizers
3. Yung-Sup Kim; Bok-Jin Kim
4. Inst. of Agricultural Sciences, Suweon 170, Republic of Korea
5. -
6. -

1. **North Korea - Corée du Nord - Nordkorea**
2. Korea Society of Soil Science
3. -
4. Pyongyang, Dem. People's Republic of Korea
5. -
6. -

1. **Malaysia - Malaisie - Malaysien**
2. Persatuan Sains Tanah Malaysia/Malaysian Soil Science Society
3. Sharifuddin b. Hj. Abdul Hamid; Mok Chak Kim
4. P.O. Box 2644, Kuala Lumpur, Malaysia
5. 186 (47); \$ 15
6. Society's Newsletter 'Berita'

1. **Mexico - Mexique - Mexiko**
2. Sociedad Mexicana de la Ciencia del Suelo
3. D. R. Manzanares; R. A. Saldaña
4. Apartado Postal no. 45, Chapingo, Edo de Mex., Mexico
5. 950 (21); \$ 300 (\$ 150 for students)
6. a. Bulletin (12)
 - b. Proceedings National Congresses of the S.M.C.S.

1. **Morocco - Maroc - Marokko**
2. Association Marocaine des Sciences du Sol
3. Z. Abderrahmane; Osrhiri Ahmed
4. B.P. 4102, Tour Hassan, Rabat, Maroc
5. 60 (52); DH 75
6. Revue scientifique de l'ANSSOL 'Attorba' (1); DH 70

1. **Netherlands - Pays-Bas - Niederlande**
2. Nederlandse Bodemkundige Vereniging/Dutch Soil Science Society
3. P. D. Jungerius; R. G. Gerritse
4. P. O. Box 30003, 9750 RA Haren, The Netherlands
5. 586 (175); Dfl. 7,50
6. Newsletter (4)

1. **New Zealand - Nouvelle-Zélande - Neuseeland**
2. New Zealand Society of Soil Science
3. J. K. Syers; R. Lee
4. C/- Soil Bureau, Private Bag, Lower Hutt, New Zealand
5. 475 (134); NS \$ 2
6. New Zealand Soil News (6)

1. **Nigeria - Nigéria - Nigerien**
2. Soil Science Society of Nigeria
3. D. O. Ataga; W. O. Enwezor
4. Department of Soil Science, University of Nigeria, Nsukka
5. 150 (57); ₦ 20
6. a. Nigerian Journal of Soil Science (1)
 - b. Proceedings of Annual Conference (1)
 - c. Newsletter, (occasional)

1. **Norway - Norvège - Norwegen**
2. Norsk Forening for Jordforskning/Norwegian Society of Soil Science
3. A. Njøs; O. Ø. Hvatum
4. Department of Soil Science, Agricultural University of Norway, P.O. Box 72, N-1432, Ås-NLH Norway
5. 71, (85); Kr. 50
6. -

1. **Pakistan**

2. Soil Science Society of Pakistan
3. H. M. Bhatti; -
4. -
5. -
6. -

1. **Philippines - Philippinen**

2. Soil Science Society of the Philippines
3. G. N. Alcasid; -
4. Bureau of Soils, Ma. Y. Orosa Street, Ermita, Manila, Philippines
5. - (25); -
6. -

1. **Poland - Pologne - Polen**

2. Polskie Towarzystwo Gleboznawcze/Polish Society of Soil Science
3. L. Królikowski; A. Kabata-Pendias
4. Ul. Wisniowa 61, 02-520 Warszawa, Poland
5. 1114, (30); Z1. 30
6. a. *Reczniki Gleboznawczy/Soil Science Annual* (1 volume of 4 numbers); Z1. 120
- b. *Przegląd Nankowej Literatury Rolniczej i Leśnej*, (1 volume of 4 numbers)
- c. *Prace Komisji Nankowych* (2-3)
- d. *Komunikaty* (2-3)

1. **Portugal**

2. Sociedade Portuguesa da Ciência do Solo/Portuguese Society of Soil Science
3. J. A. Alves; M. A. Mayer-Gonçalves
4. Instituto Superior de Agronomia, Tapada da Ajuda, 1399 Lisboa Codex, Portugal
5. 81, (70); -
6. 'Pedon'

1. **Romania - Roumanie - Rumänien**

2. Societatea Nationala Romana Pentru Stiinta Solului/Romanian National Soil Science Society
3. G. Obrojanu; D. Teaci
4. ASAS, Bd. Marasti 61, sector 1, București, Romania
5. 523, (33); L. 20.000
6. Proceedings (published on the occasion of conferences and symposia)

1. **South Africa - Afrique du Sud - Südafrika**

2. Grondkundevereniging van Suidelike Afrika/Soil Science Society of Southern Africa
3. J. M. de Villiers; R. O. Barnard
4. P. O. Box 1821, Pretoria 0001, South Africa
5. 220, (176); R. 12.50
6. a. Proceedings of Congresses, (\pm every 18 months)
- b. Newsletter (2)

1. **Spain - Espagne - Spanien**

2. Sociedad Española de la Ciencia del Suelo/Spanish Society of Soil Science
3. A. Hoyos de Castro; E. Dorado
4. Instituto de Edafología y Biología Vegetal (C.S.I.C.), Serrano, 115 bis, Madrid - 6, Spain
5. 284 (250); Pta 1.300
6. Informativo (3)

1. **Sri Lanka**

2. Soil Science Society of Ceylon
3. M. W. Thenabadu; C. S. Weeraratna
4. Dept. of Agricultural Chemistry, Faculty of Agriculture, Peradeniya, Sri Lanka
5. 72 (4); Rs. 10.000
6. Journal of the Soil Science Society of Ceylon

1. **Sweden - Suède - Schweden**

2. Swedish Society of Soil Science
3. L. G. Nilsson; L. Mattson
4. Dept. of Soil Sciences, S-750 07 Uppsala, Sweden
5. 262 (56); Kr. 15
6. -

1. Switzerland - Suisse- Schweiz

2. Bodenkundliche Gesellschaft der Schweiz/Société Suisse de Pédologie
3. H. Flühler; L. -F. Bonnard
4. Eidg. Forschungsanstalt für Landwirtschaftlichen Pflanzenbau, 8046 Zürich-Reckenholz
5. 315 (78); Fr. 25
6. Bulletin (4)

1. Tunisia - Tunisie - Tunesien

2. Association Tunisienne de la Science du Sol
3. M. Hamza; A. Hamza
4. Division des Sols, Avenue de la République, Tunis-Port, Tunisia
5. 25 (21); D 5
6. -

1. United Kingdom - Royaume-Uni - Grossbritannien

2. British Society of Soil Science
3. W. Dermott; D. V. Crawford
4. University of Nottingham, School of Agriculture, Sutton Bonington, Loughborough LE12 5RD
5. 750 (416); £ 9
6. Journal of Soil Science (4)

1. U.S.A. - E.U.A. - V.S.A.

2. Soil Science Society of America
3. R. G. Gast; M. Stelly
4. 677 South Segoe Road, Madison WI 53711 U.S.A.
5. 5800 (1700); \$ 32,-
6. a. Soil Science Society of America Journal (6)
b. Journal of Environmental Quality (4)
c. Agronomy News (Newsletter) (6); US \$ 12

1. U.S.S.R. - U.R.S.S. - Ud.S.S.R.

2. All-Union Society of Soil Scientists of the U.S.S.R.
3. V. A. Kovda; G. S. Pogodina
4. Pygevsy 7, 109017 Moscow, U.S.S.R.
5. 7000 (128); 1% from salary in Roubles
6. Journal 'Pochvovedenie'

1. Venezuela

2. Sociedad Venezolana de la Ciencia del Suelo
3. A. V. Chirinos; A. F. de Andreu
4. Apartado 1208, Santa Rosa, Maracay, Edo. Aragua, Venezuela
5. 400 (64); Bs. 400
6. Informative Bulletins, Technical Bulletins

1. Yugoslavia - Yougoslavie - Jugoslawien

2. Jugoslovensko društvo z proučavanje zemljišta/Yugoslav Society of Soil Science
3. B. Fuštić; V. Hadžić
4. 11080 Zemun, Yugoslavia
5. 300 (54); Din. 200
6. a. Zemljište i biljka (3)
b. Agrohemija (6)

1. Zimbabwe

2. Soil Science Society of Zimbabwe
3. W. D. Purves; J. K. R. Spurway
4. Chemistry and Soil Research Institute, P.O. Box 8100, Causeway, Salisbury, Zimbabwe
5. 30 (14);-
6. -

Subcommissions/Sous-Commissions/Subkommissionen - Chairmen/Présidents/Vorsitzenden

A. Salt affected soils/Sols salins/Salzböden

Prof. Dr. I. Szabolcs, Director, Research Institute for Soil Science, Herman Ottó Ut 15, Budapest 11, Hungary

B. Micromorphology/Micromorphologie/Mikromorphologie

Dr. P. Bullock, Rothamsted Experimental Station, Harpenden Herts, AL5-27Q, U.K.

Working Groups/Groupes de Travail/Arbeitsgruppen - Chairmen/Présidents/Vorsitzenden

SC Soil Conditioning/Stabilisation de la structure du sol/Bodenstrukturverbesserung (Com. I).

Prof. Dr. M. F. Boodt, State Agricultural University, R.U.G., Coupure Links 533, B-9000 Ghent, Belgium.

HS Humic Substances ('Humic Acid Reference Collection')/Matériaux humiques/Humusbestandteile

(Com. II). Dr. P. Mac Carthy, Department of Chemistry and Geochemistry, Colorado School of Mines, Golden, CO80401, U.S.A.

FT Soil Fertility/Fertilité des sols/Bodenfruchtbarkeit (Com. IV).

Dr. P. Bruin, Retired Director, Institute for Soil Fertility, P.O. Box 30003, 9750 RA Haren, The Netherlands.

(Subgroups: Quality of Crops; Yield Analysis; Nitrogen Mineralisation-Nitrogen Balance).

CS Cryogenic Soils/Sols cryogènes/kryogene Böden (Com. V).

Prof. Dr. O. V. Makeev, Institute of Agrochemistry and Soil Science, Abon. Box 21, Puschino, Moscow Region 142292, U.S.S.R.

DP Soil Information Systems/Informatique en pédologie/Informationssysteme in der Bodenkunde (Com. V).

Dr. J. Schelling, Netherlands Soil Survey Institute, P.O. Box 98, 6700 AB Wageningen, The Netherlands.

DS Desertification/Désertification/Verwüstung (Com. V).

Dr. D. R. Bumbala, c/o Ministry of Agriculture and Irrigation, Department of Agriculture, Krishi Bhavan, New Delhi 110001, India.

FS Forest Soils/Sols forestiers/Waldböden (Com. V).

Dr. R. Saly, Visoka Skola Leskina, Zvolen, Czechoslovakia.

NO Nomenclature Hydromorphic Soils/Nomenclature des sols hydromorphes/Nomenklatur hydromorphen Böden (Com. V).

Prof. Dr. E. Schlichting, Institut für Bodenkunde und Standortlehre, Universität Hohenheim, P.O. Box 106, D-7000 Stuttgart-70, B.R.D.

PP Paleopedology/Paléopédologie/Paläopedologie (Com. V; with/avec/mit INQUA).

Prof. Dr. D. H. Yaalon, Department of Geology, Hebrew University, Jerusalem 91000, Israel. (subgroups: Origin and Nature of Paleosols; Soil Stratigraphy; Dating of Paleosols; Applied Paleopedology).

RS Remote Sensing for Soil Surveys/Pédologie et Télédétection/Fernerkundung für Bodenkartographie (Com. V).

Prof. Dr. M. C. Girard, Institut National Agronomique, 78850 Thiverval, Grignon, France.

LE Land Evaluation/Evaluation des terres/Landbewertung (Com. VI).

Dr. K. J. Beek, I.T.C., P.O. Box 6, 7500 AA Enschede, The Netherlands.

CO* Soil Colloid Surfaces/Surfaces des colloïdes de sol/Bodencolloïdale Oberfläche (Com. VII).

Prof. Dr. Quirk, Waite Agricultural Research Institute, University of Adelaide, Private Bag, Glen Osmond, SA 5064 Australia.

Committee on Rules

Prof. Dr. E. G. Hallsworth (Chairman: University of Sussex, Falmer, Brighton, Sussex BN1 9RF, England); Prof. Dr. P. Buringh, Dr. R. Dudal, Prof. Dr. I. P. Garbouchev; Prof. Dr. E. Schlichting; Prof. Dr. R. Tavernier (Members); Dr. W. G. Sombroek (Secretary: P.O. Box 353, 6700 AJ Wageningen, the Netherlands).

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