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ISRIC

Since 1.1.1984: International Soil Reference and Information Centre

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1 INSTITUTIONAL DEVELOPMENTS

1.1 GENERAL TREND

The year 1983 did not yield much change in housing, financing or the number of established posts. It was nevertheless memorable in the sense that it was decided to change the name International Soil Museum into "International Soil Reference and Information Centre (ISRIC)", as per 1st January 1984, reflecting the gradual broadening of the activities. More and more the Centre is being recognized as a place of development of standards and a depository of basic information on the soil resources of the world, in particular those of developing countries; requests for assistance to the establishment of national soil reference collections in those countries multiplied.

The widening scope of ISM's activities was also recognized and supported by its International Advisory Panel, which met in June for the fourth time since the creation of ISM (for details see section 1.2). Following one of its recommendations moves were made towards the establishment of a Foundation in its own right. At the same time, ITC, as the mother and servicing institute on behalf of the Dutch Government, explored possibilities for a "management contract" with the aim of streamlining administrative arrangements. Finances, staffing and accommodation space were stretched to the limit in trying to meet the manifold demands. A requested extra support from the Dutch Government was however not awarded. The reasons are a general curtailing of its funds for international technical assistance, but also a reluctance to finance an institution which is located outside the developing world. The same may hold for international funding agencies, such as Unesco, UNEP and the European Communities, to which several project or programme proposals were submitted, without concrete results as yet.

Nevertheless, UNEP, recognizing the need for a centre such as ISM, appeared willing to make use of its potential in the framework of its World Soils Policy plan-of-action. One specific item, a four-year project for support to the core activity of ISM - a representative reference collection of all major soils of the world - was formally approved by that UN organization. Unfortunately, an acute shortage of funds caused UNEP to postpone the effective start of this project from the end of 1984 to some later date.

At the suggestion of the Dutch National Commission for Unesco, this UN agency accepted ISM's annual training course on the list of recognized Unesco courses. FAO formally submitted to the Dutch Government a project for updating of the 1:5 million Soil Map of the World, to be carried out in close cooperation with ISM. It also included the Centre in its Register of Consultants, facilitating the ad-hoc employment, on a paid basis, at any of its field projects where the specific expertise of ISM is called for. The newly created International Board for Soil Research and Management (IBSRAM) with modest initial financing by Australia, Canada and the Federal Republic of Germany took interest in the suggestion by the Dutch Government's Directorate-General for International Cooperation (DGIS) that it utilizes ISM's facilities for some of its planned central services.

Shortage of manpower and funds severely curtailed the Centre's 1983 outreach

programme, both as regards additional soil monolith collection and the on-the-spot support for the establishment of national soil reference collections. One exception was the execution of the first part of a programme of cooperation with the Institute of Soil Science in China, as a result of joint financing by the Royal Netherlands Academy of Arts and Sciences (KNAW) and the Academia Sinica.

Several people, both scientific and technical, joined ISM temporarily as volunteers thereby easing to a some extent the backlog in laboratory analyses and data storage.

1.2 FOURTH MEETING OF THE INTERNATIONAL ADVISORY PANEL

The fourth meeting of the International Advisory Panel was convened by Unesco and held in Wageningen from 13-18 June 1983, in combination with the ISM-Unesco/MAB Workshop on soil research in biosphere reserves and other MAB sites (see section 5.1). The ten-man Panel was required to review the aims and current programme of ISM and to formulate recommendations on its future orientation and programme activities. The composition of the Panel is given in section 9.2.

Background

First ideas for the International Soil Museum were formulated in 1952 and, after supporting recommendations at the 7th and 8th International Congresses of Soil Science (ISSS) in 1960 and 1964, Unesco made the Museum a project within the activities in the field of its earth sciences programme. At Unesco's General Conference in 1964, The Netherlands was chosen as the site for the Museum.

The ISM was founded in 1966 with the objective of assembling a collection of the world's major soils. These soils are studied, analysed, compared and evaluated by resident staff and guest researchers at the Museum. The Netherlands Government meets the major part of the budget and Unesco provides as small contribution. ISM works in cooperation with Unesco, FAO and the ISSS.

Panel discussions

The deliberations of the Panel took place within the context of the above background and comprised discussions on the basis of introductory statements of ISM staff on 14 items reflecting the orientation and breath of the programme.

When reviewing the achievements and progress the Panel commended in particular on the growth of the soil monolith collection; on the efforts to help developing countries create their own national soil reference collections; on the annual training course; on the quality of the Soil Monolith Papers; on the LABEX programme; and on the guest research activities. The Panel was less unanimous in judging activities not directly related to the soil monolith collection, and the standardization of soil research procedures. Further, the Panel was not in favour of ISM scientific staff to become involved in activities other than soil research, such as editing and teaching.



Meeting of the International Advisory Panel

Recommendations

A total of 16 recommendations was formulated and agreed upon by the Panel. They are given in Appendix 1.

The main thrusts of the recommendations were to concentrate activities on the prime purpose of ISM, namely the collection of monoliths of the world's main soils and their proper characterization. In relation herewith the Panel recommended to pay more attention to soil fertility and soil use, to fill geographical and taxonomic gaps, and to install a computerized data base for storage and analysis of all information on each soil monolith of the collection. The Panel considered it logical to include deeply weathered tropical soils like laterites in the collection. Further, the Panel attached great importance to the support of the establishment of national soil reference collections in developing countries.

The Panel agreed that the provision of supplementary (international) funding is very important for the future of ISM. Only if additional funding is available, should activities be expanded to encompass such items as computerization of the map catalogue, land evaluation, land resource data base, and documentary services. Additional funds would also be needed for continuation of the ISM-Unesco/MAB programme, the ISM guest research programme, ISM participation in international soil correlation efforts, and cooperation in management-oriented soil research in the tropics.

Opposing views on the future orientation of ISM's work programme became apparent during the discussions on the most appropriate new name for ISM. All Panel members agreed that the word "Museum" was too restrictive for the ISM programme.

Some Panel members supported a broad title to cover future documentary services on land resources, while others preferred a narrow title to reflect the emphasis on soil aspects, and on soil profiles in particular. After several sessions, including voting, the following name was recommended: *International Soil Reference and Information Centre (ISRIC), a centre for collection and study of soil reference materials (formerly known as the International Soil Museum).*

For the years to come, the recommendations of the Fourth International Advisory Panel will serve as guidelines for fund raising and work programming at ISRIC. It may be concluded that it will require tremendous efforts to accomplish the tasks involved.

2 REVIEWS AND ARTICLES

2.1 ON THE WAY TO IMPROVE INTERNATIONAL SOIL CLASSIFICATION AND CORRELATION: THE VARIABILITY OF ANALYTICAL DATA

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Abstract

International soil correlation, an important tool in land use technology transfer, particularly for developing countries, is hampered by the large variability of analytical data used for soil classification. This review of a limited number of national, regional and international laboratory cross-checking programmes indicates that for a worldwide use of quantitative taxonomic systems of soil classification, such as that of FAO and USDA Soil Taxonomy, standardization of methods and procedures of soil analysis is essential. Nevertheless, a certain level of variability will prove to remain unavoidable, implying that several taxonomic criteria have to be used flexibly.

Introduction

Soil analysis is a cumbersome and often unrewarding job full of expected and unexpected pitfalls. From the comparison of soil analytical data concern has emerged about the reliability of these data and consequently about the implications of their interpretation and use. This applies to a great many physical, chemical and mineralogical data used in soil mechanics, soil fertility assessment, soil classification, and characterization for other soil-related purposes. The present discussion will be restricted to problems of variability of data and dissimilarity in results among laboratories in (international) soil classification and correlation.

The need for quality control in soil analysis was already apparent in the early fifties. In Canada, a collection of reference soil samples was made available to laboratories for comparing results. After depletion of this supply in 1973, the Canadian Soil Survey Committee (CSSC) decided to set up a new reference collection of 28 samples, initially to be analyzed by 24 laboratories (7).

Interlaboratory cross-checking was also organized in the USA when it was realized that soils cross state borders and that data from two or more laboratories had to be compared. Such programmes include the Northeast Soil Characterization Study (3) comprising nine laboratories and ten soil samples, and the North Central Region Interlaboratory Comparison of Soil Characterization Data comprising eight laboratories and ten samples (8). Both schemes include the Soil Conservation Service (SCS) National Soil Survey Laboratory, Lincoln, Nebraska.

In 1981, a group of five soil laboratories in New Zealand analyzed most of the CSSC reference samples (5).

A regional programme of analysis of reference samples was initiated in 1977 by the Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD) for the Middle East and North Africa initially comprising fourteen laboratories and two soils (4).

The latter two programmes indicate the realization that cross-checking of laborato-

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ries serves wider purposes than only national ones. In fact, with the increased application of the more "universal" taxonomic classification systems such as that of FAO and USDA Soil Taxonomy, there was a growing feeling that international soil correlation was hampered by a suspected variability of analytical data. Particularly for (developing) countries which lack national soil classification systems based on long-standing soil survey activities, such correlation is indispensable for technology transfer and the most rational utilization of land (2).

A modest step in international cross-checking was taken in 1976 by the Kenya Soil Survey (KSS) that sent samples of three similar Ferralsol/Oxisol profiles for analysis to Brazil, Hawaii and Nigeria to compare the results with its own (9).

The initiative for a more comprehensive approach was taken in 1978 when the Second International Soil Classification Workshop, held in Malaysia and Thailand, recommended that a programme be initiated for cross-checking, correlating and possibly standardizing laboratory methods used for soil characterization in various parts of the world. The International Soil Reference and Information Centre (ISRIC) at Wageningen, which was asked to undertake this job, started with a pilot programme comprising 20 laboratories from all continents, involving 10 soil samples. Ten of the laboratories were located in developing countries and ten in developed countries. This scheme, too, included the SCS laboratory at Lincoln (11).

Results of Interlaboratory Analytical Studies

Before entering into an appraisal of the results obtained thus far in the various schemes, it should be pointed out that two main approaches in interlaboratory cross-checking can be distinguished, i.e., the *cooperative* approach and the *collaborative* approach. In the former, participants are free to use their own procedures, whereas in the latter participants analyze determinands according to exactly the same procedures. The cooperative study is necessary to gauge the need for "standard" procedures or possibly establish correlations between different procedures. The collaborative study

TABLE 1. Generalized variabilities of some soil parameters emanating from interlaboratory programmes

Scheme (see text)	Texture	CEC	CEC of clay	Exch. bases	Base satur.	pH	Organic carbon	15 bar moist	ESP
CSSC (Canada)	- (+)	- (+)		-- (-)		+ (-)	+ (-)	(+)	
N. East (U.S.A.)	+ (-)	+ (-)		- (+)	+ (-)	++	+ (-)	+	
N. Central (U.S.A.)	+	- (+)		+ (-)	+	+	+ (-)	+ (-)	
New Zealand) ¹	-	+-		+ (-)	+ (-)	+	+ (-)	+ (-)	
ACSAD (regional)	- (--,+)	-				+	+ (-)		--
KSS (internat.)		--	- (--)	- (+)	-	+ (-)	-		
ISRIC (internat.)	-- (-)	- (--)	--	-	- (+)	++(+)			

-- very large variability, - large variability, + moderate variability (5 - 10% rel.),
 ++ small variability (less than 5% rel.). Symbols in brackets represent significant minority.
)¹ as compared with "best value" of CSSC; internally usually better.

can be considered the most advanced since in this case a standard procedure has already been introduced and is now being tested. Obviously, the two approaches can run parallel, so that own procedures can be compared with standard procedures.

The generalized results of the schemes for a limited number of important soil parameters are presented in Table 1. Because the reported data variabilities themselves vary with soils and labs, the more important deviations from the general findings are given in brackets. The significance of this lies mainly in the (+) signs after — signs as they may indicate some optimism about possible improvement of the results. A (–) sign after + would indicate that acceptable results are obtained but that attention is still needed.

The following brief observations on the results can be made:

Canadian CSSC Compilation of Data of Reference Soil Samples (7)

This is to a large extent a collaborative scheme since most (but not all) laboratories use the CSSC procedures manual (6). The scheme was not meant primarily to test procedures but rather to facilitate quality control of participants.

Considerable discrepancies in the results were found justifying the undertaking and its continuation. Although little information on the individual performances is given, there were clear indications that the variations were largely due to the analyst rather than to differences in methods. Despite of the wide variations, many results clustered around mean values and “best values” could be established with some confidence. These values will be tentative yardsticks for future work. Canadian labs were urged to routinely include these reference samples in their analyses and report values periodically.

U.S.A. Northeast Soil Characterization Study (3)

This is probably to a large extent also a collaborative scheme since it may be assumed that all laboratories use the procedures of the USDA Soil Conservation Service (10). This is borne out by the generally reasonable variabilities that were obtained. There seems to be need and room for improvements, however. The project is to be continued.

U.S.A. North Central Region Interlaboratory Comparison (8)

This scheme is very similar to the previous one, as are the results. In the recommendation for future work, the use of duplicates (and even triplicates) is emphasized to evaluate within-lab variation and interactions of soil and laboratory.

New Zealand Interlaboratory Comparison (5)

This is basically a cooperative study since Canadian samples were analyzed in N.Z. according to local procedures (1). Some comparison between labs in N.Z. could be made at the same time, however. It appeared that this international comparison was not in all cases satisfactory and that local results compared generally better.

ACSAD Regional Program of Analysis of Reference Samples (4)

Since no statement about methods is made, this is probably a cooperative programme. Only two samples of great regional importance were used: one from a saline

calcareous soil and one from a saline, calcareous and gypsiferous soil. It is no surprise that the results show large variations. Such soils are usually a soil chemist's despair. Even such simple analyses as Ca and K in groundwater, however, gave disturbingly high aberrations. By contrast, the pH values were all rather close, which is unexpected under neutral to alkaline conditions.

The reporter (4) urges the initiation of cooperation between countries dealing with similar problems to improve some basic analytical methods for soil characterization. It was suggested to start with soluble and exchangeable sodium, CEC and gypsum.

Kenya Soil Survey Comparison of Data (9)

This small international cooperative study yielded widely varying results for the most important soil parameters. Of interest are the concluding remarks of the report: "More comparative analysis by international laboratories on some characteristic profiles of major classification units is wanted. The divergence in the values of exchangeable cations, acidity, CEC and therefore base saturation percentage between four laboratories, would illustrate the problems that arise if CEC and base saturation are taken as important criteria in international soil correlation work. For the time being, field characteristics, with simple laboratory confirmation should be the main guide".

ISRIC Laboratory Methods and Data Exchange Program (11)

The pilot round of this cooperative programme aimed at international standardization indicates a large variability in data of a few key parameters used in soil classification. These variabilities significantly exceeded those obtained in the national laboratory schemes. In several cases this led to different classifications of the same soil, illustrating the frustration of international soil correlation. Yet, although this is not clear from Table 1, the data also contained good indications that improvement of the variability should be well possible by detailed standardization of analytical procedures. Therefore, ISRIC is to continue its programme in an expanded form, with more participating laboratories and more soil samples. The organization of an international workshop on standardization is also planned.

The above results indicate that if quantitative taxonomic systems for soil classification are to be used globally, the methods and procedures have to be standardized in detail. All reports of the interlaboratory comparison schemes emphasize the importance of cross-checking, and the feasibility of standardization seems to be indicated. Despite this, however, even after thorough standardization, a certain minimum level of variability will appear to remain unavoidable.

With the establishment of differentiating classification criteria, this aspect has to be taken into account.

Classification aspects of the variability of data

In view of the efforts to reduce the variability of analytical data, it is worth looking at the consequences of the unavoidable minimum level of variability with respect to international soil classification. From the ISRIC programme (11) the following estimates

of attainable variability of some important parameters were made:

Clay content:	11%	
CEC of the clay:	25%	(relative figures)
Base saturation:	10%	

These figures may well have to be readjusted in due course. On the one hand, the expectation of the standardization effect may be too pessimistic, but, on the other, certain disturbing factors such as sampling variability, seasonal variation and contaminations have not been taken into account. At any rate, they indicate that several quantitative taxonomic criteria have to be used with flexibility. A few examples may illustrate this:

Clay content

The criterion for argillic horizon in soils with more than 40% clay is an increase of 8% in clay content. At 50% clay, the variability of analysis means that the actually found clay content may vary between approximately 45% and 55%. This is a range larger than the criterion itself! In many cases, the error may not be so large since the whole profile is analyzed by the same laboratory, preferably in one batch. Yet, in case of a Nitosol/Ultisol in the ISRIC programme, 2 out of 20 labs actually measured a clay *decrease* in the argillic horizon.

CEC of the clay

The CEC of the clay is used to distinguish Ferralsols/Oxisols from other soils (<16 me/100 g) and to identify ferrallic/oxic properties (<24 me/100 g). The estimated variability of 25% means that the 16 me boundary should have an elasticity of 12-20 me and the 24 me boundary of 18-30 me. In the ISRIC study, these sharp boundaries proved to give rise to conflicting classifications.

An additional factor contributing to the variability of this parameter seems to be the organic carbon content of the sample for which no subtraction is applied. This could, however, easily be eliminated.

Base saturation %

Two important boundary values of base saturation are 35% and 50% to differentiate between Acrisols/Ultisols and Luvisols/Alfisols, and for eutric and dystric subdivision. These sharp boundaries, too, cause conflicting classifications. The variability of 10% (relative) indicates that these boundaries should range from 31.5% to 38.5% and from 45% to 55%, respectively.

In his report on the Northeast Soil Characterization Study, Cronce (3) states: "Instead of making decisions based only on the absolute values reported, it must be considered that values, as determined by one or more soil characterization labs, may

vary within certain known limits". To some soil scientists, the idea of using such boundary values flexibly may come as a shock, whereas for others it is only a natural thing to do. Especially the younger ones who have learned "to live by the book" may belong to the former category, whereas the not so young ones, who have seen the systems develop and who have a lot of surveying and correlation experience, perhaps better realize the origin of the boundary values. These are, after all, compromises originating from clusters of values found for certain groups of soils. From this point of view it is only realistic that these boundary values, in practice, are used as the middle value of a range. In such boundary cases, classification will then have to be based on other, accessory soil properties such as specific surface area, natural clay %, presence or absence of clay skins, structure and aggregate stability.

The diffuse character of boundary values has, of course, fundamentally nothing to do with variability of analytical data; it is put forward here only as an additional legitimate excuse to employ analytical data with inherent uncertainties.

It is actually unfortunate that the discussion is focussed so much on boundary problems since this is, in fact, only a discussion on slight errors or variabilities. The real objective should be to reduce the much larger errors on either side of a classification boundary. These are therefore not expressed in the classification but may be of considerable importance in establishing the actual soil qualities.

It may serve as some comfort that in soil survey work, for which soil classification is a tool, the mapping units are usually based on the classification of several pedons so that misclassification of a single pedon should not be fatal.

This, however, should not distract us from the need to standardize soil analysis internationally and, subsequently, to keep up the good performance by continuous checking.

Wilson (12), in his discussion on analytical standardization in general, warns that it would be an illusion to expect rapid progress. It is preferred to carry out a standardization effort very carefully as simplifications and short-cuts on the basis of insufficient evidence may lead to lack of success and wasted effort.

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2.2 INFORMATION EXCHANGE FOR EARTH SCIENTISTS WORKING IN LATERITE AREAS

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Abstract

Essential problems in communication on laterite research are identified, both at the international and the interdisciplinary levels. Procedures for dissemination of information are considered. The case is presented for the establishment of an International Interdisciplinary Collection of Reference Laterite Profiles, and the publication of a Handbook on the Description of Laterites and Laterite profiles, for interdisciplinary use.

A better exchange of information on laterites has become essential, as new techniques have made available an enormous variety of data, as yet lacking the coherence and transferability necessary for its full value to be applied to the needs of developing countries.

Introduction

Standardisation of terms to describe laterite structures and textures was one of the aims of IGCP-129, a UNESCO sponsored International Geological Correlation Programme project entitled Lateritisation Processes. As an interdisciplinary project it offered the first real opportunity for geologists, geomorphologists, soil scientists, geographers etc., to come together and rationalise the descriptive terms they use, so that information exchange is improved. This understates the existing problem. In fact interdisciplinary communication has been very poor indeed. Each discipline has tended to function independently, developing its own terminology. Their approaches to the study of laterite often overlap or run parallel and in many cases scientists pertaining to a particular discipline know that they could benefit from adopting the techniques used by other disciplines and from greater familiarity with their published findings. Yet interdisciplinary communication remains poor. Each discipline continues to function as an individual strand in the cord, the full strength of which is only achieved when the strands intertwine and act together. Co-ordination is the essence of the Correlation Programmes but of the tropics dealt with in the programmes the study of lateritisation is perhaps unique in that the correlation needed is both international and interdisciplinary.

Terminology was thus of high priority to IGCP-129. The project has now terminated and a successor project is being proposed. It is appropriate at this time to review the achievements of the last projects and assess the aims of the successor, as far as terminology is concerned. It would be counter-productive to pretend that the Working Party, established to tackle this problem, has achieved a successful rationalisation of the terms used. Involvement in this problem was disappointingly sparse and the reasons are not difficult to find. Some were reluctant to be involved with semantics, a time consuming business, rather unproductive for the individuals concerned: their time could be better used in pursuit of their own particular research. Many others, who realised that

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their own research would fail to reach a full audience without standard terminology, still held back because they felt the problem to be too big and virtually irresolvable. There were also undertones of interdisciplinary competition; "they should use our terms". For those who did become involved with this difficult topic there were two problems. First, the range of textures inevitably reaches beyond the experience of even the most widely travelled earth scientists. Dr. G.J.J. Aleva, one of the members of the Working Party, clearly showed the variety of structural and textural types with which he has met, and yet numerous individual voices could claim knowledge of yet other textures and structures. Second, the descriptive terms used by individuals failed to exclude genetic implications, these being based on their own particular experience. These genetic interpretations may or may not be correct, but they are undesirable since they provide grounds for dispute. The main object of standard terminology is to provide some ground which is beyond dispute, ground which provides a platform for discussion and resolution of disputes.

Despite the general lack of enthusiasm about involvement with terminology problems, there emerged, during the life-span of IGCP-129, an interdisciplinary group actively concerned with tackling them. The establishment of this group forms a viable foundation which is now attracting a more positive contribution from scientists from traditionally estranged disciplines. This contribution stems from the recognition, by the Working Party, of the real problems involved and the emergence of a realistic way of dealing with them to the satisfaction of the majority. Indeed the achievement of IGCP-129 in this respect may be summarised as (a) recognition of the real problems and (b) a realistic proposal for dealing with them. Nor is this achievement to be belittled in view of the one and a half centuries of preceding terminological disorganisation. A concerted effort made during the successor project can achieve a good first approximation which will be modified, no doubt, in the years to come, but will provide a real basis for information exchange between scientists with varied aims throughout the Developing World.

The nature of the terminology problem

Laterite structures and textures are extremely varied, but they may be described in terms of three essential components: (1) discrete segregations, (2) continuous phases, (3) voids. It is the discrete segregations which are often the most prominent feature and it was these which first received attention to the extent that they were named. Most striking were the small, round, zoned or banded segregations, similar to calcareous oololiths and the adoption of the term 'oololiths' to describe them had genetic undertones as it was, for a brief period, believed that like calcareous oololiths they formed in shallow water. The name pisoliths was given to larger, rounded, bodies about the size of a pea. The terms were soon extended to include bodies which were not zoned or banded. Inevitably a wide range of segregations, different genetically and different in appearance became described as oololiths and pisoliths, the terms still retaining size as a diagnostic criterion. The terms nodule and concretion were used to cater for segregations larger or less regular in shape. Today, it is this size criterion which is the only generally used classification of discrete segregations; discontent stems from the knowledge that the division between classes is arbitrary and in many cases not only genetically meaningless but also very confusing. Similarly formed segregations may vary in size and genetically

different forms may fall within the same size range. Moreover, a simple size distinction is impracticable because many laterite profiles contain a wide size range of segregations. In some cases the size of segregations grades from oolitic, through pisolitic to nodular in the profile and in many cases all of them in varying abundance, may be present in any particular horizon. To confuse the situation further, in addition to these 'umbrella' terms, ill-defined synonyms, and pseudosynonyms were used, eg. ooides, pisoids, shot, etc. Similar confusion arose concerning voids (cavities) and continuous phase structures - tubes, pipes, cellular and vesicular structures, vermiform and vermicular cavities etc.

The need for standard terminology

"Does it really matter?" we may ask, if the term pisolith is used for a wide range of segregations including, for example, unbanded segregations (iron-impregnated lithorelics or soil relics), zoned variations of these, coated variations, with single or multiple coats, segregations completely built of coatings around a nucleus etc. It is now known that these variations in structure are genetically significant. They indicate variations in leaching history and associated with the different structures are different mineral and chemical assemblages. If we are concerned with more effective mineral exploration, genetic criteria must be established and used. If we are concerned with laterite chemistry and mineralogy, either to identify laterites of economic interest or to locate base metal concentrations beneath a laterite, then texture and structure are often used as guides to local variations in chemical and mineral content. If an economic concentration is found, in one area, to be associated with certain structures, then further exploration often bears in mind those 'pathfinder' structures. This use of structure depends entirely upon familiarity with them. Continuity of exploration staff at the national level makes this feasible, but what we need now is to disseminate that familiarity to others, in widely spaced lateritic environments, who could also use them as reference points. Yet at present we cannot do this. Without standardisation of terminology there is no way that key information of this sort can be exchanged. Structural 'pathfinders' then have to be re-discovered again and again in separate places.

A more specific example can be provided for those concerned with geochemical prospecting in lateritic areas. Alexander and Cady (1962) recognised the ability of *certain* pisoliths to encapsulate and protect early weathering products from weathering and leaching. This was confirmed in Ugandan pisolithic laterites (McFarlane 1969) and more recently Leprun (1981) provided considerable detail on this. He found that in the near-surface horizons where these pisoliths are concentrated, there was corresponding concentration of the relatively less weathered components. Lower in the profile, where the pisoliths are more widely dispersed, concentration of these components was less. Clearly, the near-surface horizons are likely to be the most informative about the mineral content of the parent rock. This genetically very useful generalisation cannot, however, be applied elsewhere unless it is clear that the pisoliths elsewhere are genetically similar. In some laterites, those formed in freely draining situations, the reverse is true. The pisolithic horizon at the top of the profile is the least informative and the deeper the sampling the better, because with depth the iron is less well organised and the ion adsorption capacity is higher than in the pisolithic horizon where crystallinity of the Fe

minerals is good (McFarlane 1983). In short, we now know that different 'pisoliths' indicate genetic situations in which the potential for encapsulation, adsorption and isomorphous substitution, associated with phase changes, varies. Hence if we are to exchange information about these it is essential that we know what kind of pisoliths we are talking about. This is not a matter of semantics but of serious concern in applied earth science.

Problems facing standard terminology

If different structures indicate different modes of formation and are associated with different chemical and mineral assemblages, we must be able to define genetically different structures in terms of their configuration or appearance. Herein lies an essential problem. Although we need descriptive terms which will in effect separate genetic classes, because the genesis of these structures is poorly understood we must not pre-empt progress by using genetic terms as descriptive terms. We need purely descriptive terms. Only when we have these will it become possible for individuals in widely separate parts of the world to exchange information about the genetic context of similar features. From this can come a consensus of opinion about the situations in which they form, how their formation is brought about and what the characteristic mineralogical and chemical assemblages are. Only then can we see an end to the futile arguments about, for example, how pisoliths form. If the term is used indiscriminately to describe several genetically different features then there must be several right answers to this question. It is quite striking how little disagreement there is about genesis when geoscientists from different parts of the world are assembled at any particular exposure. The excursions associated with the two international seminars of IGCP-129 provided many opportunities to see that it is exchange of information about structures which is at the heart of our problems.

One of the first difficulties of which the Working Party became aware was that *because the aims of different scientists vary the importance of distinctions varied*. For example, to someone concerned with genesis, the size differences between similar segregations may not be important, but to a hydrologist the segregate size and the associated void size may be crucial. Frequency of segregations may be crucial to soil scientists and of a little significance to others. Zonation of segregations may be important to mineralogists and geochemists and of little concern to agronomists etc. Clearly we need to know who cares about what, i.e. where lie meaningful boundaries for different disciplines. This is essentially a logistics problem. We need individuals to communicate their preferences, no matter how restricted their concern or how small their area of experience. The second component to the solution of this problem is the existence of a working group able to receive and collate this information, to digest it and to cater for the needs expressed. This we now have and so the solution to the problem rests squarely with each individual to state his needs. It is a major purpose of this paper to disseminate the information that the Working Party has an effective administrative base at ISRIC, Wageningen, The Netherlands. At the same time the paper is meant to invite constructive comment and opinion. Now is not the time to withhold opinion, allow others to develop a classification (which will inevitably fall short of perfect) and then either claim

that it is unworkable and refuse to adopt it, or, worse, to 'contribute' by belated criticism.

The second problem which very quickly emerged was that even between us (the Working Party) our experience of laterite simply has not encompassed as many of the different types as is necessary for us to begin to contemplate (a) placing meaningful boundaries between structural types (b) formulate terms to describe the groups within the boundaries. If we had representative examples of all types, assembled under one roof, then we could make a reasonable first approximation of structural types. Here again progress has been made in that we now have a home, again at Wageningen, to which samples can be sent. Samples may be in the form of polished sections, colour plates or slides and black and white plates. To facilitate this, counsellors, representing various disciplines, have been appointed in a wide range of countries. They will function as regional representatives to co-ordinate local efforts to contribute to the collection.

With a good collection of structural types we can define terms but we would like to do more than this:

1. It should be possible to link textures and structures with chemistry and mineralogy. Lack of analytical facilities may deter individuals from making a contribution. Clearly, wherever possible we would like the analyses from the contributor but possibilities exist for undertaking these at Wageningen or for making arrangements to have analyses carried out at other institutions, if the material is of sufficient interest to justify analyses. Those in a position to undertake their own analyses should contact the collection organiser in order to liaise concerning techniques (It should also be pointed out that standard materials are now available as a result of the efforts of Dr. LaBrecque and his colleagues for IGCP-129). Those in a position to offer material without analyses should contact either the organisers or their regional counsellors, for assessment of their analytical needs, with a view to collaboration with another institute. Institutes or individuals able to offer analytical facilities, or able to undertake analyses are urged to make themselves known to the organisers or regional representatives.

2. We would like to be able to place samples in as full a genetic context as possible - place in the profile, place of the profile in the catena, place of the catena in the lithological sequence, the geomorphological history etc. Wherever possible, contributors should provide as much contextural information as possible, but again it may be possible to arrange for subsidiary contextural research where the interest of a profile justifies it. Academic institutions in particular are urged to make known their willingness to allocate research students to assignments which the organisers believe to be of particular genetic interest.

The Medium Term Aim

1. The most immediate aim of this activity is to classify textural types and produce descriptive criteria and terminology. This can certainly be achieved within the life-span of the successor project to IGCP-129, at the termination of which a handbook will be

produced, which includes black and white line drawings to illustrate descriptive criteria. The Handbook for soil thin section description (Bullock et al. in press) functions as a model in many respects. It is planned to accompany this handbook with a coloured wall chart of the main types.

2. It is planned to display at ISRIC a range of complete laterite profiles, these providing an overview of world types. The upper parts of the profiles would be exhibited as soil monoliths in the exposition of ISRIC and selected sections of the lower parts of the deep profiles would be displayed. Subsidiary samples in contextural relationship with the main profiles will also be presented, to indicate local variations of significance. Photographs and drawings of landscape and lithological setting and detailed description and laboratory analyses (geochemistry and mineralogy) would accompany this and would also be made available on illustrated information sheets.

This display aims to present profiles at different stages of development, over a range of rock types, to illustrate (a) temporal variations, i.e. stage of development (b) variations attributed to lithology (c) similarities attributable not to lithology but to other genetic factors, especially leaching history, as controlled by geomorphological history.

For the time being, about fifteen complete profiles can be accommodated. They should include at least the following: lateritic bauxites; karst bauxites; nickel laterites ("valley" and silicate types); plinthites; well developed but uneconomic laterites (high level and low level); and manganiferous and ferruginous laterites.

It is highly desirable that comparable regional or national collections are developed to illustrate variations particularly relevant to different areas of the tropics. These regional collections, in combination with the international collection, will provide students of laterite with both a world overview and a regional overview *in only two locations*, an opportunity to gain a very wide experience of laterites, with a minimum outlay of travel funds. Clearly, only the preliminaries for a network of regional collections can be laid during the successor project. Several are already being developed (for example the collection of the Natural History Museum of the University of Ife, Nigeria) or are being considered (for example in Suriname).

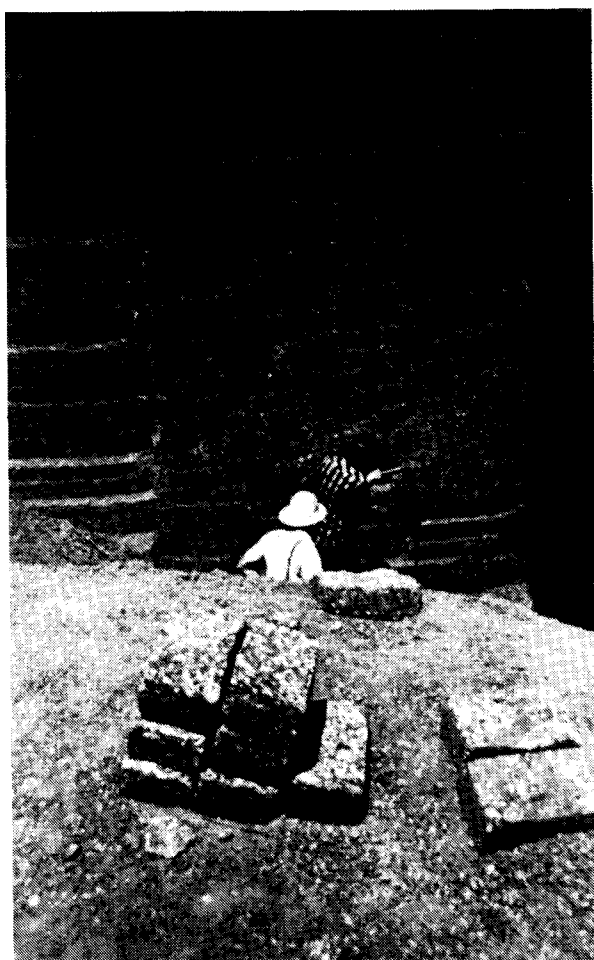
The Long Term Aim

Analytical technology has expanded enormously in recent years, and its use is becoming widespread. Data has become available at an unprecedented rate and the need for central or national data storage systems is urgent. Computerisation of this data, both for analytical purposes and to facilitate appropriate retrieval is an important aim. This aim is impracticable without adequate ordering of the information and a key ingredient in the ordering is textural classification. The Working Party on textural classification aims to provide that ingredient of data ordering, which will enable effective storage, effective in terms of meaningful information exchange at both the international and inter-disciplinary levels.

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Note: A short version of this text was presented at the International Geological Congress, Moscow, U.S.S.R., August 1984, by Prof. Dr. S. Kroonenberg of the Agricultural University Wageningen.



Type locality of Buchanan's laterite ("plinthite") in Southern India, showing the traditional brick-cutting activity

3 ACTIVITIES OF THE SECTIONS

3.1 SOIL MONOLITH COLLECTION

During the reporting period the number of soil monoliths increased with 35 to 588 (see table below).

Acquisitions in 1983

Brazil: As already mentioned in section 7.1 of Annual Report 1982, ISM is involved in the establishment of CORLAT, the Interdisciplinary Collection of Reference Laterite Profiles (see also section 5.3). The first core down to a depth of 17 metres, taken from a lateritic bauxite formed in Pliocene sediments in the Amazon region, has now arrived. The upper two metres constitute a soil profile.

People's Republic of China: In cooperation with the Institute of Soil Science, Academia Sinica, Nanjing, eight profiles were collected by Dr. O.C. Spaargaren of ISM in Southeastern China (see section 5.2). The project is extended for a year (1984) and may be extended further.

Indonesia: Within the framework of the Land Evaluation Project Planning Area III, Aceh Tengah and Aceh Utara, Sumatra, six profiles have been collected by Dr. C.G.G. van Beek, of ITC, Enschede, The Netherlands, and Dr. P. Buurman, Agricultural University Wageningen, The Netherlands.

Kenya: With the cooperation of Mr. H.W. Boxem, Training Project in Pedology, Kilifi, ISM received six profiles, which were taken in the coastal zone of Kenya.

Malaysia: With the cooperation of Dr. J.P. Andriese, Royal Tropical Institute, Amsterdam, The Netherlands, one soil profile was taken by Mr. Kim Chin Pang, Soil Survey Division, Kuching, Sarawak. This profile completes the chonosequence illustrating the formation in beach deposits of a Humic Podzol from a Calcaric Fluvisol in about 6000 years.

Mozambique: Five profiles received from the Department of Soils and Water, INIA, Maputo, illustrate the diversity of red soils (Luvisols, Acrisols, Nitosols, Ferralsols) in Northern Mozambique, while three profiles are different Planosols from the Limpopo alluvial plain. This work was carried out by Messrs. J.H. Kauffman, C. Konstapel and M. Vilanculos (see also chapter 4).

Netherlands: As part of the annual training course (see section 3.7) a large number of profiles has been collected as study material. Five of these have been selected for the regular collection, including four monoliths illustrating the formation of different Podzols in Pleistocene cover sands.

Monolith collection, December 1983

Within parentheses: acquisition in 1983

Australia	33	Mali	1
Belgium	4	Mozambique	8 (8)
Botswana	7	Namibia	11
Brazil	1 (1)	Netherlands	24 (5)
Cameroon	1	New Zealand	5
Canada	21	Nigeria	14
People's Rep. of China	8 (8)	Norway	3
Colombia	19	Oman	4
Czechoslovakia	8	Philippines	6
Denmark (Greenland)	6	Romania	11
Finland	5	Rep. of South Africa	20
France	11	Spain	18
Fed. Rep. of Germany	17	Sri Lanka	4
Ghana	4	Sweden	17
Greece	14	Syria	4
Hungary	20	Thailand	13
India	30	Turkey	13
Indonesia	22 (6)	United Kingdom	11
Ireland	11	U.S.A.	10
Italy	17	U.S.S.R.	62
Jamaica	3	Uruguay	1
Japan	4	West Samoa	5
Kenya	33 (6)	Yugoslavia	3
Malaysia	11 (1)	Zambia	10
		Total	588(35)



Arrival of a standard
ISM container
with soil profiles from
the People's Republic of China

General

Arrangements for collecting soil profiles have been made with institutions and individuals in a number of countries. Some of these have plans for the establishment or enlargement of soil reference collections for their own purpose.

The countries with which ISM is in contact include: Brazil, Burundi, People's Republic of China, Ecuador, Ethiopia, Indonesia, Israel, Kenya, Malaysia, Mali, Mexico, Pakistan, Poland, Portugal, Rwanda, Spain (Canary Islands), Sri Lanka, Sudan, U.S.A., Venezuela, Vietnam and several countries in North and West Africa and the Near East.

Most of the sampling will be carried out by non-ISM soil scientists, part of whom are participants of the annual training course.

Preparation of monoliths

During the reporting period about 30 profiles have been impregnated and prepared for exhibition. During the annual training course about sixteen soils were treated as exercise, and five of these have been selected to form part of the regular collection. Also, a growing number of soils needs to be repaired; parts of the soil having become loose.

Although the search for less toxic chemicals for the impregnation of mineral and organic soils is continuing, so far none were found to be fully adequate for the purpose.

3.2 LABORATORY

Regular analytical work

In connection with the programme on volcanic ash soils (see chapter 4), during the first half of the year the analytical work was concentrated on all (21) Andosol monoliths of the ISM collection.

The analyses of two monoliths, from Uruguay and Nigeria, were completed for a study by two students of the M.Sc. Course of the Agricultural University Wageningen. For Dr. N.M. Pons-Ghitulescu, who is preparing a Soil Monolith Paper on a Chernozem from Romania, two Chernozems collected by her in France were analyzed for comparison. Also analyzed were two monoliths from the site (near Wageningen) of ISM's training course. Other monoliths of which the analyses were completed are from: Cameroon (1), Greece (1), Malaysia (1), Mozambique (5), Philippines (5) and Sri Lanka (4). In total 40 monoliths of the collection were analyzed.

Analytical work not related to the collection ("small projects")

Because the laboratory was in the favourable position to have two volunteer analysts and an apprentice-analyst at its disposal, considerable time could be spent on analytical work not directly related to the monolith collection. There is an increasing demand for "odd jobs", especially requests from developing countries for analysis of a

few samples on one or two parameters (usually CEC and particle size distribution) for reference purposes. ISM tries to comply with such request as much as possible. These special projects are listed in section 5.5. Jobs of less than a man-day work are not included in this list.

Research

Research was continued on two major analytical method-related topics: 1. The correlation of the silver thiourea CEC method with the ammonium acetate method, and 2. The influence of the pre-treatment on the particle size analyses. Both projects are planned to be terminated in 1984. Other research activities were largely related to the Andosol programme (see chapter 4).

Programme on comparison of methods, procedures and results of laboratory analysis for classification purposes (LABEX)

The Royal Tropical Institute (KIT) at Amsterdam carried out the analysis of the samples sent in by the participants of LABEX. The job consisted of over 400 CEC and particle size analyses. The data were forwarded to participants together with a questionnaire inviting comments and suggestions as to the follow-up of the pilot round. A number of participants was asked to supply some additional data so that a complete set of base saturation and pH figures was obtained as an extension of the pilot round. Statistical treatment of these data was started by the end of the year. Meanwhile, a request for funding a 3-year project on standardization of analytical procedures was submitted to the Dutch Directorate-General for International Cooperation (DGIS). A decision on this is expected early 1984.

3.3 MICROMORPHOLOGY

Technical work

The preparation of thin sections is carried out by the technician of ISM at the laboratory of the Dutch Soil Survey Institute (Stiboka).

In 1983, 291 thin sections have been made. 224 thin sections were made for the regular ISM collection, concerning 8 from Cameroon, 60 from P.R. of China, 17 from Colombia, 3 from Gabon, 14 from Italy, 34 from Kenya, 3 from Malaysia, 29 from Philippines, 45 from Sri Lanka, 5 from United Kingdom, 6 from Uruguay. Thin sections for special projects include 13 for the MAB project (Indonesia), 2 for ITC (training project in Tunisia), 4 for Dr. W.G. Sombroek (Amazon laterites), 3 for Mr. F.A. Milho da Conceição (Portugal), 42 for the participants from India of the course on soil micromorphology (see below), 3 from India (taken during the ISSS congress).

Samples for treatment were received from Australia, Indonesia, Japan, Kenya, The Netherlands, and Rwanda.

Considerable time of the technician was spent on assisting in the Training Programme in Micromorphology as part of the Project: Establishment of a Soil Micro-

morphological Unit and Characterization of Benchmark Soils of India, a cooperation project between the National Bureau for Soil Survey and Land Use Planning in Nagpur India, Stiboka, and ISM. Most of the period of 16 May - 23 September has been used for this purpose. In addition, training in micromorphological techniques was given to Mr. D.T. Loc from Vietnam during one week.

A project involving the improvement of impregnation techniques by using gamma-rays was initiated. Samples were taken in the field for this purpose.

Investigations

The investigations of the thin sections of the collection of ISM is lagging behind. This is a matter of concern since the micromorphological interpretation is considered to be an integral part of the total investigation of the soil profile. An important reason for this is the lack of a universally accepted system of description. To date many descriptions have been made by trial and error, but only a limited number would qualify for publication. With the introduction of the ISSS-sponsored system of description a commencement has been made in 1983 with the description according to this method.

A training programme was organized and photomicrographs were prepared for

Mr. J. Prasad from India and Mr. D.T. Loc from Vietnam for one and two months respectively. Two students of the M.Sc. Course of the Agricultural University Wageningen, were coached and assisted during the study of thin sections relevant to the preparation of their theses. Photomicrographs were prepared for illustration of these research papers and for a publication on acid sulphate soils by Dr. D. Dent, University of East Anglia, England.



Training of a micromorphologist

Reference collection of thin sections

The Subcommittee on Soil Micromorphology of the ISSS, recognizing the importance of the large collection of samples of soils from all over the world now available at ISM, has officially requested ISM to set up a reference collection of thin sections. The purpose of such a reference collection is to clarify and to make more easily understood the criteria of the ISSS Descriptive System and so to arrive at a better characterization of diagnostic soil horizons and properties. It is expected that this collection would contribute to a better communication between micromorphologists and to a better understanding of micromorphological information by non-micromorphologists.

A start has been made at ISM with the establishment of this reference collection.

Initial discussions have taken place and a selection of the first samples has been made.

The feasibility of an exchange with or sale to major micromorphological laboratories of such a reference set is being considered. Although it is realized that photomicrographs never can replace the actual thin sections it has been decided to prepare a corresponding set of diapositives as the comparatively low costs of such a set allows a much wider distribution of the reference materials.

3.4 DOCUMENTATION

Soil monolith documentation

For each soil monolith a file is kept for storage of all information collected in the field and from the literature, analytical data and results of interpretative study at ISM. The data should be stored systematically and be completed where necessary. The minimum data set should be sufficient to allow the proper classification of the soils.

In 1983, the files of a large number of soil monoliths have been rearranged, screened and completed where possible. This updating of the soil monolith documentation included the following activities:

- Soil profile description. Many field descriptions are incomplete, and are not made according to the FAO guidelines for soil profile description. Some field descriptions are not made on exactly the same location where the monolith was taken. The field description was checked on the soil monolith and completed. In addition, a judgment of the state of the soil monolith is given, specifying needs for repair.
- Soil laboratory data. Analytical data of the soil monoliths, both from ISM and from other sources, were checked. Doubtful and missing data were identified, and completed if needed for classification purposes.
- Thin sections. Information on available thin sections and their descriptions is also kept in the general file.
- Photographs and slides. Information is given on available photographs of the soil profiles in the field, of landscape, land use and vegetation, as well as those on the soil monolith and thin sections.
- Classification of the soils according to the FAO-Unesco Soil Map of the World legend and to USDA Soil Taxonomy.

These activities required a coordinated effort of the different sections of ISM, while some information was obtained through correspondence with the collectors over past years of the soil monoliths or the cooperating institutes in the country of origin. The files of the ISM profiles from the following countries have been updated: Australia, Belgium, Botswana, Cameroon, Colombia, Indonesia (partly), Malaysia (Serawak), Nigeria, Oman, Philippines, Sri Lanka and Zambia.

Map collection

Cartographic materials form an integral part of the library's regional section, where maps and reports are catalogued by country, or by group of countries. Geographic coverage of the ISM collection is the whole world with emphasis on developing coun-

tries. The coverage in subjects is dominated by soil and related geographic information on climate, ecology, vegetation, land use, land capability, geology, geomorphology. At present the map collection includes about 4000 mostly colour-printed sheets and some 600 photonegatives and transparencies.

The acquisition policy is to obtain world coverage of soil maps at reconnaissance and smaller scales, examples of more detailed soil maps and index maps lists of all soil surveys carried out in a country. Other thematic maps are sought after mainly if they complement soil information. The selection criteria are relevance of the maps for soil science, agricultural development and environmental issues.

The major purpose of maintaining the map collection is their use for the possible updating of the Soil Map of the World at scale 1:5 million and the compilation of a new, computerized world soil map at 1:1 million. The map collection serves as a source of basic information for use by scientists, students and consultants in soil correlation studies and in the preparation of missions abroad.

Library

The present library collection includes more than 4100 publications, about 2500 of which are on a regional basis, mostly reports on soil and land surveys. The remainder is constituted mainly by textbooks on soil science and related subjects, bibliographies and atlases. There is an annual increase of two to three hundred publications. In addition, ISM has subscriptions to 35 journals.

Sales section

In the reporting period the new Monograph 1 and accompanying wall chart on Podzols and related soils have been added to the sales collection. New prints were made of the ISM publication "Field Extract of Soil Taxonomy" and the USDA/SCS publication "Handbook of Soil Survey Investigations - Field Procedures".

3.5 SOIL CLASSIFICATION AND CORRELATION

ISM continued to collect all relevant information on soil classification systems currently in use in the world. Arrangements for publication of an English language field extract of "Classification des Sols" by an ORSTOM working group, were in an advanced stage of preparation towards the end of the year. An agreement-in-principle was made with the National Brazilian Soil Survey Organization (SNLCS-EMBRAPA) to issue a similar English-language field extract on their new classification system. Dr. W.G. Sombroek, with the support of the micromorphology and laboratory staff, worked out proposals for subdivision of the argillic horizon, which he presented at the international Symposium of Red Soils held in Nanjing, China in November.

These activities are in support of the current international efforts to arrive at an International Reference Base for soil classification (IRB), which is a joint project of ISSS, FAO, Unesco and UNEP. It endeavours to develop a system of four categoric

levels, taking the existing FAO-Unesco Soil Map of the World terminology as starting point, that will harmonize the different approaches to soil classification (USA, USSR, France, Brazil and others); it will, moreover, develop guidelines for more detailed systems of classification as appropriate for the needs of individual countries or groups of countries, especially those in the tropics.

Depending on the kind and extent of international funding, e.g. by UNEP, ISM may become involved to some degree in the execution of the project. In anticipation, the Director was appointed a member of the Steering Committee for the project.

3.6 EDUCATION AND INFORMATION

In 1983 the total number of registered visitors was about 1500, which is about 10 percent less than in the preceding year. This decrease is on account of persons visiting ISM in groups; the number of individual visitors remained at the same level. The decrease in group visits results from the policy of ISM to discourage visits by groups of non-professionals and of students from The Netherlands that have only an elementary knowledge of soil science. ISM was impelled to introduce this policy because no public relations officer could be appointed yet, and the reception of groups and the required preparations for introductory lectures and instruction puts too heavy a burden on the regular staff. The number of group visits from abroad remained nearly the same.

Dr. J. Dijkerman of the M.Sc. Course in Soil Science and Water Management, Agricultural University Wageningen, discusses some soils with course participants
(photo Rein Heij)



Group visits

About 1260 persons visited ISM in groups, mainly from educational institutions such as universities, teacher courses, agricultural and technical colleges and from international training courses and congresses (see Appendix 2). The ISM exhibition has been incorporated in the courses on regional soil science of the Agricultural University and the M.Sc. Course in Soil Science and Water Management in Wageningen, of the Tropical Section of the National Agricultural College, Deventer and of other international courses held in The Netherlands e.g. at ITC, Enschede. In addition, groups of students are regularly coming from Belgium, France, F.R. Germany, Scandinavia and the United Kingdom.

Individual visits

The number of people coming individually or in very small groups that have signed the guestbook in the exhibition hall (after their visit) amounts to about 200. It was experienced however that only part of the visitors signs this book. Most visitors are professional soil scientists, and two-third of them come from abroad. Furthermore, many visitors consulted the library and map collection, or popped in for discussions with ISM staff.

Field trip with students from Portsmouth Polytechnic, England



Lectures by guests

In 1983 a number of guests of ISM has presented lectures on topics related to their research. The lectures were held at the premises of ISM; staff members of the Universities in Amsterdam, Utrecht and Wageningen, and many others were invited to attend.

- Dr. P.J. Farres (Portsmouth Polytechnic, U.K.) on Rainsplash and Soil Crusting
- Prof. E. Mendelovici (Venezuela, temporary at Technion, Haifa, Israel) on Mechano-chemical Transformations of Iron - and Aluminium oxides in Soils
- Dr. M.J. McFarlane (Reading University, U.K.) on Laterites and Landscape
- Dr. C. Mizota (Kyushu University, Japan) on Clay Mineralogy and Chemistry of Andosols and Related Soils from Different Climatic Regimes.



Dr. M.J. McFarlane lectures on laterites

Extramural lectures

As in the previous years, staff members of ISM participated in the Basic Course Soil Survey of ITC, Enschede, The Netherlands by giving lectures on special topics of soil classification and soil genesis. Both the USDA system of classification and the FAO-Unesco Soil Map of the World were discussed. These lectures are illustrated with slides, hand-outs, lecture notes and other materials derived from the ISM collection.

At the College on Soil Physics of the International Centre for Theoretical Physics (ICTP) in Trieste, Italy, an introduction was given on soil genesis, classification and geography of the world's soils.

3.7 TRAINING

International Course on the Establishment and Use of Soil Reference Collection

The Third International Course on the Establishment and Use of Soil Reference Collections was held at ISM from 11 April to 13 May 1983 under the direction of Dr. O.C. Spaargaren.

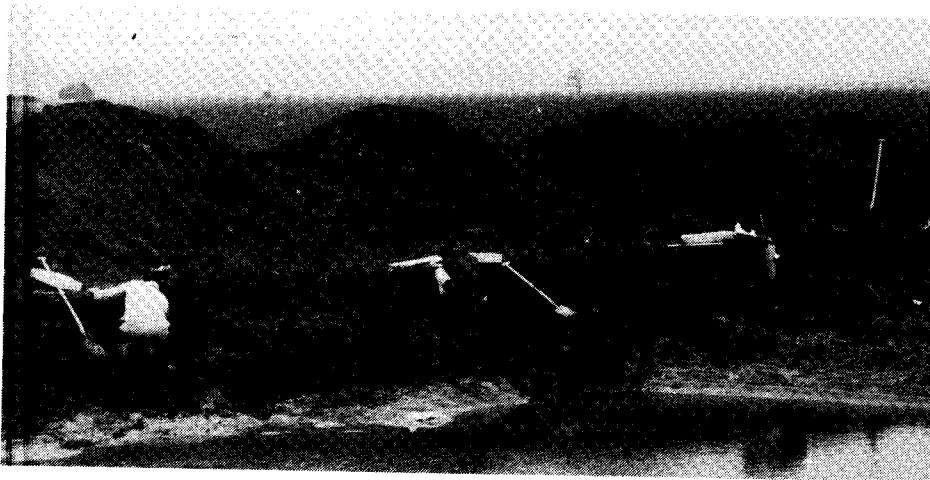
The course was attended by five participants, four from Asia and one from Europe. Three participants were sponsored by Unesco, one was financed by an FAO fellowship and one participated on his own funds. The participants were:

- Mr. J.B.S. Ekanayake, Land Use Division, Irrigation Dept., Colombo, Sri Lanka (Unesco);

- Mr. D.T. Loc, Institute for Soils and Fertilizers, Hanoi, Vietnam (FAO);
- Mr. F.A. Milho da Conceição, Centre for Tropical Soil Studies, Lissabon, Portugal (own);
- Mr. A.M. Sudihardjo, Centre for Soil Research, Bogor, Indonesia (Unesco);
- Mr. M.A. Tahir, Soil Survey of Pakistan, Lahore, Pakistan (Unesco).

The course activities were broadly divided as follows:

- collection of soil materials and additional information in the field
- preparation of soil monoliths in the workshop
- associated lectures and exercises in the museum
- preparation and presentation of a final exhibition, including literature research for additional data
- follow-up discussions
- excursions



Participants of the international training course taking soil profiles

All participants completed the course and received a certificate of attendance. Follow-up activities are related to the establishment of soil reference collections in the respective countries.

At the fourth course it is intended to have the majority of the participants from Arab countries.

Individual training

After completion of the international course on soil reference collections (see above) Mr. Loc received a supplementary training during two weeks in soil profile description and classification. This was followed by a seven-week training in soil micromorphology.

Ms. M.C. Angueira from Argentina/Uruguay received a short training in some laboratory procedures.

4 GUEST RESEARCH

Preparation of a Soil Monolith Paper on a representative soil from Romania

(Dr. N.M. Pons-Ghitulescu)

Period: 1 January - 31 December 1983.

Considerable progress was made in the preparation of the Soil Monolith Paper on the FAO-Unesco soil unit Calcic Chernozem, using a soil monolith from Romania as reference. Literature research was carried out to correlate the formation of the black surface horizon with climatic aspects like frost, snow cover, rainfall and temperature regimes, with biological activity and with parent material in order to explain differences in soil characteristics in the major regions of occurrence of Calcic Chernozems: Eastern Europe and North America. Contacts were maintained with Prof. R. Tavernier, Ghent, Belgium of the Soil Map of Europe project. Some additional field observations were made in France (intrazonal variant of a Calcic Chernozem) and in Yugoslavia. The Paper will be published in French, with an English abstract.

Interdisciplinary Collection of Reference Laterite Profiles (CORLAT)

(Mr. M.L. Moura)

Period: 1 January - 31 December 1983.

Progress on CORLAT is reported in section 5.3. In addition, Mr. Moura carried out research on methods for CEC determination in the laboratory.

Contribution to the establishment of a reference base for red clayey soils in Mozambique

(Mr. J.H. Kauffman, Maputo, P.R. of Mozambique)

Period: 1 October - 31 December 1983.

Funding: Netherlands Directorate-General for International Cooperation (DGIS).

The expert was associated with the National Institute for Agricultural Research (INIA), Maputo, Mozambique, through the "Soil Survey and Land Evaluation Project" of DGIS. His study forms a part of the research programme of the Department of Pedology of INIA which aims at a better understanding of the well drained, deep, highly weathered, red, clayey soils of the tropical region of Mozambique.

These deep red clayey soils occupy the greater part of the northern half of Mozambique and constitute one of the country's most important land reserves. Knowledge of their distribution and properties is essential to guide future agricultural development. Up to now, some of the soils belonging to this group have been described in different soil surveys, but no attempt has been made to study them systematically by correlating the existing information. The classification of the red soils in Mozambique is further hampered by the fact that their characteristics do not correspond with the central concepts of diagnostic soil horizons used in internationally known soil classification systems such as Soil Taxonomy and the FAO-Unesco Soil Map of the World legend. This applies especially to the definitions of the argillic and oxic B horizons, resulting in uncertainties at the highest level of classification. It is therefore important to

obtain a better knowledge of the red clayey soils through the establishment of diagnostic criteria for the distinction of different kinds of red soils; the establishment of criteria of the different red soils in various soil classification systems; the drawing of pragmatic subdivisions of the different red soils for land evaluation purposes; the compilation of data on red soils from previous soil surveys for statistical analysis and reclassification; and through the establishment of a reference collection of red soils, including soil monoliths, soil sample material and thin sections.

The classification system, data files and profile collection together will form a reference base for previous and future soil surveys of red soils in Mozambique, to be established by the Department of Pedology of INIA in Maputo.

Twenty locations in Northern Mozambique have been selected as reference sites, representative for large areas and covering a wide range in altitude, geology, landform and vegetation. Each site has been described and sampled for laboratory analysis of its vegetation, parent material and soil. Soil profiles have been collected at five of these sites simultaneously for INIA/University in Maputo and for ISM.

The research at ISM aims at making a contribution to the establishment of the national soil reference base in Maputo by analyzing soil samples, elaborating field and laboratory data and comparing them with data from literature. In this effort the Dutch Soil Survey Institute (Stiboka) participates in the preparation and analysis of thin sections and the Agricultural University Wageningen with statistical analysis.

Characterization and comparison of the clay mineralogy of Andosols and related soils from diverse climatic regimes

(Dr. C. Mizota, Kyushu, Japan)

Period: 1 July - 31 December 1983.

Funding: Kyushu University and Netherlands Ministry of Agriculture and Fisheries, through the International Agricultural Centre.

During the second half on the year, Dr. Chitoshi Mizota of Kyushu University, Japan, spent his sabbatical leave at ISM to study the topic mentioned above. He put to good use all Andosols of the ISM collection and took along two monoliths from Japan. The incentive of this study was the noted but still partly unexplained influence of climate on the weathering of volcanic ash. Particularly semi-arid climates such as in East Africa lead to a peculiar mineralogy of the clay fraction of soils on volcanic ash.

Technical support for this project was rendered by the Dutch Soil Survey Institute (Stiboka); the Netherlands Institute for Sea Research (NIOZ) and the Dept. of Soil Science and Geology, Agricultural University Wageningen. The results will be presented at the International Panel on Volcanic Soils, Tenerife (1984) and published in ISM Monograph number 2.

5 PROJECTS

5.1 SOIL STUDIES IN "MAN AND THE BIOSPHERE" (MAB) PROJECT SITES

The programme of support to soil studies in Man and the Biosphere (MAB) reserves and research sites in developing countries, through the backstopping of three associate soil scientists employed by Unesco through DGIS, continued during the year. The results obtained so far were compiled, compared and discussed during a Workshop held at ISM from 15-19 June 1983, concurrently with the meeting of its International Advisory Panel (see section 1.2). It resulted in a further harmonization of the methodology to be employed in the three regions covered by the soils programme (Africa, Latin America, and Southeast Asia). It was also specified that most of the laboratory analyses required for individual field studies should be carried out in the respective countries, but that ISM can assist with specialistic analysis and for comparative soil classification purposes.

At the suggestion of the Unesco representative it was decided that comprehensive guidelines are to be prepared for the benefit of future studies by national soil scientists in countries with MAB areas. These guidelines shall be published in due course by Unesco in its series MAB Technical Notes. The Note will be accompanied by a colour-printed map of a reconnaissance survey in Northern Kenya and several maplets annex schematic cross sections of detailed surveys and site evaluation.

It was also agreed that the three associate experts give more attention to the collection of soil monoliths from representative sites in the MAB reserves and research sites and to the assembling of all newly published small-scale soil maps and reports in the three regions in general, for the benefit of ISM's soil-geographical documentation.

The explanation, through talks and articles in the appropriate fora, of the importance of soil ecological studies in general, and in relation to the various Unesco-MAB projects in particular, is another part of the duties of the three associates.

Progress per region

Africa (Mr. A.J. van Kekem, affiliated with ROSTA, Nairobi, Kenya; since July 1983 based at Abidjan, Ivory Coast).

The soil studies in the Mount Kulal- Marsabit area in Northern Kenya were completed. The soil map at scale 1:250,000 is available in draft, a colour-printed version is in preparation. The report includes detailed descriptions of the soil mapping units and a chapter on land evaluation.

The soil survey was carried out in the framework of the Unesco-UNEP Integrated Project on Arid Lands (IPAL), which aims at finding solutions for the most urgent environmental problems associated with desert encroachment and ecological degradation of arid lands. The soil survey forms an important part in the study of the functioning of the ecosystem and together with studies on the vegetation is the base for a land evaluation study. The results of the studies are integrated in a management plan for the area which may lead to an improvement of the natural environment and of the existence base of the pastoralists.

The soil study in the rainforest of the M'Passa Biosphere Reserve, Makokou, Gabon, carried out in support of research on the functioning of the forest ecosystem, was nearly completed by the end of the year, awaiting the results of soil analyses.

Preparations were made for soil studies in the Tai National Park in Ivory Coast, one of the last remains of the once vast primary forest zone in West Africa. It is planned to carry out a soil survey of the Park area (330,000 ha.) at scale 1:250,000. Special attention will be given to soil-vegetation relationships.

The soil scientist attended the International Workshop on Land Evaluation for Extensive Grazing, Addis Ababa, Ethiopia, where also a paper was presented on the IPAL study area.

Latin America and the Caribbean (Mr. R.F. Breimer, based at ROSTLAC, Montevideo, Uruguay).

Preparations for the colour-printing of the soil map at scale 1:100,000 of the Mapimi Biosphere Reserve (174,000 ha.), Durango State, Mexico, continued at ITC in Enschede and the report was nearly completed at the end of 1983. The soil study was needed for the drafting of a management plan of the area, aiming to protect the desert tortoise and simultaneously to improve the quality of the grasslands for ranching purposes.

Soil studies of the Pampa de Achala Reserve (70,000 ha.), Province of Cordoba, Argentina, resulted in an overall soil map of the area at scale 1:50,000. The finalization of the report is expected for 1984, awaiting laboratory data. The soil study was needed for research on erosion under grazing and for watershed management planning.

Other activities included:

- short mission to the San Guillermo Biosphere Reserve, San Juan, Argentina to evaluate infrastructure improvement needs
- cooperation with the Erosion Measurement Project of the Catholic University, Chile, in the design of soil loss measurement experiments
- lecturing in land classification for the post-graduate USAID course on Land Capability Classification in Tarija, Bolivia.

The soil scientist attended the following meetings:

- Seminar on Environments and Alternative Technologies for Human Settlements in Arid Zones, Antofagasta, Chile
- Meeting on Soil Conservation in the River Plata Basin Countries, Montevideo, Uruguay
- 10th Argentinian and 7th Latinamerican Congress on Soil Science, Mar del Plata, Argentina
- Seminar on Research and Management of Mountainous Arid and Semi-arid Reserves, San Juan, Argentina.

Southeast Asia (Mr. H. van Reuler, based at ROSTSEA, Jakarta, Indonesia)

Field work in the Bukit Raya Nature reserve, Central Kalimantan, Indonesia was completed. It concerned a very detailed soil study of 1,040 ha., needed to complement a botanical research project, carried out in cooperation with the Rijksherbarium, Leiden, The Netherlands.

A soil survey was made of the Ujung Kulon National Park (52,500 ha.) West Java Province, Indonesia, where the Javan rhinoceros is to be saved from extinction. Ecological studies included the animal's behaviour and its food requirements. The soil map at scale 1:150,000 is complementary to a vegetation study and together they provide information for the management of the area, based on its natural carrying capacity for rhino's.

The soil scientist participated in an expedition to the Berbak Nature Reserve on Sumatra (see section 5.5).

The work in Gunung Gede - Gunung Pangrango continued.

By the end of the year, postponed fieldwork was carried out in the Sakaeret Environmental Research Station, Thailand, in cooperation with the National Soil Survey Division of the Department of Land Development, Bangkok.

Reports and maps are in various stages of preparation, most of them awaiting the results of laboratory analyses. This applies also to the soil study of the Krakatau islands (2,500 ha.), Sunda Strait, Indonesia.

The soil scientist contributed as co-author two papers to the Centennial Krakatau Commemoration Conference: "The impact of the 1883 Krakatau eruption on the soils and vegetation of the Ujung Kulon peninsula, West Java, Indonesia" and the other one on brown soils of one of the Krakatau islands.

5.2 COOPERATION WITH THE PEOPLE'S REPUBLIC OF CHINA

Since 1980 a cooperative programme has been developed between the Nanjing Institute of Soil Science, Academia Sinica, and the International Soil Museum, Wageningen, for strengthening scientific relations and exchanges. The cooperative programme is jointly funded by the Academia Sinica (Chinese Academy of Sciences) and the Royal Netherlands Academy of Arts and Sciences (KNAW). This programme includes exchange visits by soil scientists.

For ISM, Dr. O.C. Spaargaren made a two-months soils study tour through a part of Southeastern China for the following purposes:

- to study soils and agricultural practices in Southeastern China, including collection of representative soil monoliths with accompanying documentation, to be incorporated in the ISM soil monolith collection.
- to study, evaluate and advise on updating of the existing soil monolith collection at the Institute of Soil Science, Nanjing
- to carry out correlation of the Chinese soil classification system with the FAO-Unesco Soil Map of the World legend
- to train Chinese counterparts in the selection, preparation and preservation of soil monoliths, using techniques and impregnation materials provided by ISM.

After preparatory discussions at the host institute and its various departments, including an inspection of the existing soil monolith collection, a one-month field tour was made. Eight soil profiles were taken for the ISM collection.

These profiles represent two paddy soils and six from the uplands of the subtropical region with red and yellow soils. Of one profile a duplicate was taken for the Chinese collection, to serve as an example to demonstrate impregnation and conservation techniques employed at ISM.

The scientific discussions focussed on soil classification, soil correlation and soil analyses. A "Preliminary proposal for updating, improvement and enlargement of the Nanjing Institute of Soil Science, Academia Sinica, Soil Reference Collection" was prepared, as well as a table showing "Correlation between Chinese 1:10 million soil legend and FAO-Unesco Legend of the Soil Map of the World".

In addition, lectures were given on the aims and programme of ISM, on soil monolith treatment, on travel impressions in China, on soil correlation, and on weathering and soil formation.

In November 1983, the ISM Director paid a two-week visit to China, to attend the International Symposium on Red Soils organized by the Nanjing Institute of Soil Science, and to discuss cooperation in the years ahead.

5.3 INTERDISCIPLINARY COLLECTION OF REFERENCE LATERITE PROFILES (CORLAT)

At the Second International Seminar on Lateritization Processes held in July 1982 at the University of Sao Paulo, Brazil in the framework of the Unesco-IUGS project IGCP-129 the need was confirmed to form an Interdisciplinary Collection of Reference Laterite Profiles (CORLAT) and it was agreed that the International Soil Museum (ISM) would be the best place to house this important collection (see also item 2.1).

The purpose of CORLAT is to provide the basis for a rational descriptive terminology and for classification of laterites. The potential users of the collection include geologists, mineralogists, geomorphologists, civil engineers and soil scientists.

The reference collection is to be composed of 12 to 15 selected whole "laterite profiles" (usually of 5—50 m. depth). A provisional list of the key profiles under consideration includes lateritic bauxites, karst bauxites, nickel laterites, profiles with plinthite, manganiferous laterite profiles and profiles relevant to geochemical prospecting.

The upper part of the profiles will be exhibited as monoliths in the exposition room of ISM, a second part and selected sections of the lower parts of the whole profile will be presented, in due course, in a adequate high-ceiling room. Detailed description and laboratory analysis shall be carried out and the results presented.

Subsidiary sample material shall be collected to study the local heterogeneity and the relationship between these samples and the key profile. To date, two profiles have been



Emblem of the soil studies cooperation programme with the People's Republic of China

collected in Brazil and Irian Jaya. In order to organize the collection and scientific description (including analyses) of the laterite profiles for the international collection, the creation of a working group (Working Party) was proposed at the meeting on laterite textures and structures held in Ghent, Belgium, in October 1983. The Working Party represents the interest of pedology, geology/mineralogy, geomorphology/microbiology and the engineering properties of laterites. Members of the Working Party are:

- Dr. G.J.J. Aleva (*industry*), The Netherlands
- Dr. Gy. Bardossy (*mineralogy/bauxites*), Hungary
- Prof. R. Burland (*engineering properties*), U.K.
- Dr. C.R.M. Butt (*geochemical prospection*), Australia
- Dr. M. Hermelin (*education*), Colombia
- Dr. M.J. McFarlane (*geomorphology*), U.K.
- Mr. M.L. Moura (*secretary*), The Netherlands
- Dr. W.G. Sombroek (*soil science/agronomy*), The Netherlands
- Dr. G. Stoops (*soil science*), Belgium

It is planned that the Working Party will be assisted by a group of counselors. The composition of the latter group will be such that a reasonable scientific and geographic coverage is obtained.

At ISM, pre-project preparation are in progress. A first proposal on the scope of the reference collection, and the likely requirements in staff and space, was prepared by ISM's guest researcher Mr. M.L. Moura and submitted to the authorities concerned. For the moment, the first laterite profile (a core of 17 meters of a lateritic bauxite in Trombetas, Amazon, Brazil) is under study at ISM.

The complete programme for the analyses of these profiles (chemical and physical properties, technological properties for highway engineering, microbiological study) is scheduled to start in 1985. Further work will concentrate on the acquisition of data on selected laterite profiles and literature research on analytical methods applied to lateritic materials.

5.4 ISM-ELSEVIER CHART OF WORLD SOILS

This cooperative project of ISM and Elsevier's Publishing Company embraces the production of a wall chart of about 110 x 160 cm, showing 106 colour photographs of soils illustrating the units of the FAO-Unesco Soil Map of the World legend and enlisting six of the major soil classification systems. It is expected that the chart will become available in 1985.

5.5 SPECIAL PROJECTS

Polders of the World Exhibition. The hand-coloured 1:5 million world map of soils with impeded drainage, prepared by ISM for the Polders of the World symposium in Lelystad, 1982, has been put on display for about 6 months at the exhibition centre of the Directorate Agricultural Research in Wageningen.

Berbak Nature Reserve, Indonesia. ISM provided support to the ecological studies by three M.Sc. students of Utrecht University of the Berbak Nature Reserve, located in the central part of the swamplands of Eastern Sumatra, Indonesia. The students were guided by Mr. H. van Reuler of Unesco-MAB (see 5.1) and Mr. W.H. Diemont from the Research Institute for Nature Management (RIN). The work was in part supported by a special grant from the Netherlands Directorate-General for Development Cooperation (DGIS), and it is hoped that this study results in specific recommendations for research and development of the Peat and Acid Sulphate Soils prevalent in the area.

Gabon. X-ray diffractometry of the clay of 4 samples (Unesco-MAB)

Greece. Soil moisture characteristics (pF-curves) of 48 core samples (ITC).

Indonesia. Elemental analysis of 20 Krakatau volcanic ash samples. Full analysis (including X-ray diffractometry) of 20 samples from Ujung Kulon and of 40 samples from Bukit Raya (Unesco-MAB).

People's Republic of China. Analysis of 3 profiles (exploratory investigations ISM-Royal Netherlands Academy of Arts and Sciences (KNAW) project).

Spain. Ionic composition of 200 groundwater samples (ITC).

Sri Lanka. X-ray diffraction of the clay, CEC and exchangeable bases of 8 samples (ITC). X-ray diffraction of the clay of 22 samples (ITC).

Thailand. Analysis of 5 samples (ITC).

Tunisia. Analysis of 17 samples. Guinier X-ray photos of 3 samples (ITC).

6 TRAVELS AND MISSIONS

(83/1) ICRISAT-IBSNAT-SMSS Symposium on Minimum Data Sets for Agrotechnology Transfer, Hyderabad, India, March 1983, organized by the USAID project International Benchmark Site Network for Agrotechnology Transfer (IBSNAT), the USAID programme on Soil Management Support Services (SMSS) and hosted by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). *Participant: W.G. Sombroek.*

Discussions on the organization of a research network for the monitoring of soil-climate-crop performance, and the use of generated data in crop growth simulation models. The research should cover a wide range in geographic distribution, agro-climatic zones, soils, and management levels. Minimum sets of data to be recorded on each site were defined for each discipline.

(83/2) International Meeting on Soil Biological Processes and Soil Fertility, Reading, U.K., and meeting of ICSU's **Interunion Commission on the Application of Science to Agriculture, Forestry and Aquaculture (CASAF)**, London, July 1983. *Participant: W.G. Sombroek.*

Conclusions of the Reading meeting, organized by the British and International Societies of Soil Science, are a need for coordinated interdisciplinary research in field situations, for adequate site characterization and for more attention to soil biological processes in the tropics. Some conclusions of the CASAF meeting of the International Council of Scientific Unions (ICSU) were: review of ongoing and proposed research directed to the needs of developing countries, and coordination of applied and fundamental research at different institutes from many places.

(83/3) IBSRAM-ACIAR International Workshop on Tackling Soil Constraints to Food Production in the Tropics, Townsville, Australia, September 1983. *Participant: W.G. Sombroek.*

Formal foundation of the International Board for Soil Research and Management (IBSRAM). Presentation of a paper "The International Soil Museum (ISM); past, present and future". Discussions on soil research programming by the Australian Centre for International Agricultural Research (ACIAR). Participation in a soil excursion.

(83/4) Soils study tour to the People's Republic of China, Nanjing and Southeastern China, June-August 1983. *Participant: O.C. Spaargaren.*

For details see section 5.2.

(83/5) College on Soil Physics, ICTP, Trieste, Italy and **visit to FAO Headquarters**, Rome, Italy, September 1983. *Participant: J.H.V. van Baren.*

Lecturing at the First College on Soil Physics, held at the International Centre for Theoretical Physics (ICTP).

Strengthening of contacts between FAO and ISM, contribution to FAO paper with soil photographs, registration of ISM as a prospective subcontractor.

(83/6) Working visit to Yugoslavia, July 1983. Participant: N.M. Pons-Ghitulescu.

Soil survey in connection with archaeological site at Opovo-Ygar, Bajbuk, Yugoslavia. Collection of information for ISM Soil Monolith Paper 7.

(83/7) Third Consultation on an International Reference Base for soil classification (IRB), Sofia, Bulgaria, October 1983. Participant: W.G. Sombroek.

Discussions on the use of limited UNEP funding for the IRB project. Formation of an eight man steering committee, including the Director ISM, and of 16 specialist committees for each major group of soils. Technical discussions on principles of the scheme.

(83/8) Visit to Soil Science Institutions in Japan, and International Symposium on Red Soils, Nanjing, P.R. of China, November 1983. Participant: W.G. Sombroek.

On invitation of the Japanese Society of Soil Science, lecturing to promote awareness on world soil problems with soil scientists and planning specialists at the National Institute for Agricultural Science, National Institute for Research Advancement and University of Agriculture and Technology, all in Tokyo, and at Kyoto University. Press interviews. For symposium see section 5.2.

(83/9) Fifth Meeting of the Eastern African Subcommittee for Soil Correlation and Land Evaluation, Wad Medani, Sudan, December 1983, convened by FAO. Participant: R.F. van de Weg (staff member of Dutch Soil Survey Institute, also representing ISM).

Reinforcing contacts. Discussions on establishing national soil reference collections and on scope of ISM.

7 RELATIONS WITH OTHER INSTITUTIONS

7.1 INTERNATIONAL RELATIONS AND ACTIVITIES

Contacts and activities with international organizations included the following:

Food and Agricultural Organization of the United Nations (FAO)

- Updating of the FAO-Unesco Soil Map of the World
- Elaboration of an International Reference Base for soil classification (IRB) (see section 3.5)
- Registration of ISM as prospective subcontractor, notably for consultancies on the establishment of soil reference collections
- Exchange of publications and documentation
- Representation of FAO in Unesco's International Advisory Panel for ISM (see section 1.2)
- FAO advice to ISM on the preparation of the Chart of World Soils.

United Nations Educational, Scientific and Cultural Organization (Unesco)

- Unesco-ISM cooperative programme for soil studies in project areas of Unesco's "Man and the Biosphere" (MAB) programme (see section 5.1).
- Unesco support for ISM's International Course on the Establishment and Use of Soil Reference Collections (see section 3.7)
- Unesco's International Advisory Panel for ISM (see section 1.2)
- Establishment of the Interdisciplinary Collection of Reference Laterite Profiles (CORLAT) at ISM (see section 5.3).

United Nations Environment Programme (UNEP)

- Possible financial support for the elaboration of an International Reference Base for soil classification (IRB) (see section 3.5)
- Possible financial support for the "Establishment of a Referential Soil Profile Collection based on the Soil Map of the World" at ISM, as part of the implementation of UNEP's Plan of Action for World Soils Policy
- Possible ISM participation in the Global Resource Data Base, to be established by UNEP's Global Environment Monitoring Systems (GEMS) Programme Activity Centre
- Coordination on the Establishment of National Soil Reference Collections in developing countries, to be financed by UNEP from a special fund to promote "clearing house activities".

International Society of Soil Science (ISSS)

- Assistance to the Secretariat General of the ISSS, housed at ISM
- ISM participation in the ISSS Working Group "International Reference Base for soil classification" (IRB) (see section 3.5)

- Representation of ISSS in Unesco's International Advisory Panel for ISM (see section 1.2)
- Establishment of a reference collection of thin sections of soils at ISM (see section 3.3).

Commission of the European Communities

- In response to a call for proposals for participation in a research and development programme "Science and Technology for Development" of the Directorate-General Science Research and Development (DG XII) ISM requested financial support for "Research on surface sealing of (sub)tropical soils"
- ISM requested DG XII for regular programme support that would apply to ISM's documentary services on soil resources of the countries of Africa, the Caribbean and the Pacific associated with the EC (ACP countries) for which the European Commission has founded a Documentation Centre in Ede-Wageningen.

International Board for Soil Research and Management (IBSRAM)

IBSRAM is a new international soils agency, formally established at a meeting at Townsville, Australia, 13 September 1983. IBSRAM activities will include coordination of soil related research in the tropics through Soil Management Networks with the aim to tackle soil constraints that limit food production and agricultural development. Future cooperation between ISM and IBSRAM may include ISM to provide soil documentation, and to contribute in developing a methodology for the assessment of soil qualities, as attributes in the rating of land productivity under agricultural use.

International Institute of Tropical Agriculture (IITA)

Discussions on possible mission of ISM consultant to make a soil survey of the IITA research grounds (Ibadan, Nigeria), paying particular attention to soil degradation aspects.

Office de la Recherche Scientifique et Technique Outre-Mer (ORSTOM)

- Exchange of publications
- Preparation of English version of "Projet de Classification des Sols" for publication by ISM.

7.2 NATIONAL RELATIONS AND ACTIVITIES

The following major contacts were maintained:

- International Institute for Aerial Survey and Earth Sciences (ITC) at Enschede, and its Department of Soil Science in particular (lecturing, ad-hoc training)
- Royal Tropical Institute (KIT) at Amsterdam, Department of Agricultural Research in general and its Division of Soil Science and Agrochemistry in particular (the joint ISM-KIT laboratory exchange programme LABEX)

- Agricultural University (LH) at Wageningen, in particular its Department of Soil Science and Geology (soil monolith collection and characterization), its Department of Soils and Fertilizers (fertility testing of selected soils), and its M.Sc. Course in Soil Science and Water Management (instruction)
- The Dutch Soil Survey Institute (Stiboka) at Wageningen (micromorphology; determination of physical properties of soils; cartography; project preparation; job mediation)
- The Netherlands Foundation for the Advancement of Tropical Research (WOTRO) at The Hague (collection of reference laterite profiles CORLAT)
- The Soil Departments of the University of Utrecht (international soil classifications, soil monolith collection) and of the University of Amsterdam (map collection, publications, representation).
- The International Agricultural Centre (IAC) in Wageningen and its Project Advisory Committee (fellowships; visitors accommodation; technical assistance projects; job mediation)
- The Royal Netherlands Academy of Arts and Sciences (KNAW) at Amsterdam (exchange programme with the People's Republic of China)
- The Directorate Agricultural Research (DLO) and Directorate Agricultural Assistance Developing Countries (AHO) of the Ministry of Agriculture and Fisheries (several programmes and activities)
- The International Education and Research Division of the Ministry of Foreign Affairs and the Ministry of Education and Sciences (several programmes and activities; restructuring of ISM)
- International Institute for Land Reclamation and Improvement (ILRI) at Wageningen, which convened the Acid Sulphate Soils Research Party. ISM participated, together with LH and Stiboka, in its Working Group on the inventory, classification and evaluation of acid sulphate soils (see also section 5.5 on Berbak Nature Reserve, Indonesia).

8 PUBLICATIONS

8.1 SOIL MONOLITH PAPERS

Considerable progress was made on the preparation of two Soil Monolith Papers, viz. "SMP 3, Placic Podzol (Placaquod), Ireland" by D. Creutzberg in cooperation with Messrs. J. Kiely and S. Diamond of the Agricultural Institute in Ireland, and "SMP 7, Calcic Chernozem (Vermic Haplustoll), Romania" by N.M. Pons-Ghitulescu (see chapter 4).

The SMP format has been used by two M.Sc. students of the Agricultural University Wageningen, for their theses, viz. "Environmental setting and characteristics of an Eutric Planosol of the Merin Lagoon area of Uruguay-Brazil" by Ms. C. Angueira from Argentina/Uruguay, and "Ferric Luvisol (Oxic Paleustalf), Nigeria" by P.N. Korvah from Liberia (see also section 3.7).

8.2 TECHNICAL PAPERS

- A third printing was made of TP 4 and a second printing of TP 6.
- Editing of TP 7 "Project of Soil Classification" translated from French has been completed. It outlines a new world soil classification system, conceived by a working group of pedologists of the French Office de la Recherche Scientifique et Technique Outre-Mer (ORSTOM), directed by P. Segalen, published by ORSTOM in 1979 (301 pages). Editors: P. Segalen and C.A. van Diepen.
- A first draft of "Some aspects of the display of soil monoliths and relevant information" was prepared by W.C.W.A. Bomer and J.H.V. van Baren, based on lecture notes and practical exercises prepared for some training courses.
- A draft edition of a paper "Introduction to physico-chemical aspects of soil formation" based on lecture notes of the ITC course, prepared by L.P. van Reeuwijk, was issued.
- EMBRAPA-SNLCS, Rio de Janeiro, Brazil translated LABEX report (TP 6) into Portuguese and published this as Documentos SNLCS no. 7.

8.3 WALL CHART

As a complement to ISM Monograph 1, Podzols and podzolization in temperate region (1982), a wall chart of 70 x 100 cm was published. Colour plates of 41 soil profiles and two photomicrographs show the variation of podzols and related soils. Most soils belong to the ISM collection. The chart was compiled by C.A. van Diepen and P. Buurman; the photography and lay-out are by W.C.W.A. Bomer.

8.4 ANNUAL REPORT 1982

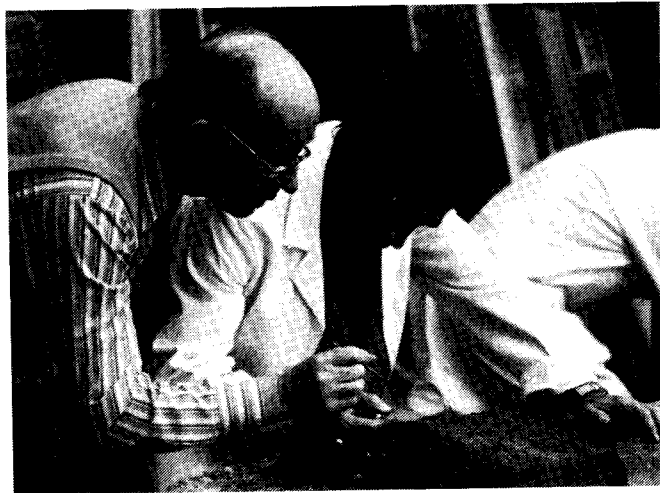
An annual report over the preceding year was issued as usual. It includes two

articles, viz. "The merits of small scale mapping of soil resources" by W.G. Sombroek and "Evaluating land evaluation" by C.A. van Diepen.

8.5 MISCELLANEOUS

One article of ISM staff was published in 1983:

- Boekschoten, G.J., P. Buurman & L.P. van Reeuwijk (1983). Zeolites and palygorskite as weathering products of pillow lava in Curaçao. In: M.W. van den Berg and R. Felix (eds.) Special issue in the honour of J.D. de Jong - Geologie en Mijnbouw 62, 409-415.



The technician in monolith preparation, W. Bomer, teaches 'the finishing touch' to a course participant

9 PERSONNEL

9.1 ISM BOARD OF MANAGEMENT

Members of the Board of Management were on 31 December 1983:

- Prof. Dr. Ir. G.H. Bolt, Chairman Netherlands Advisory Council
- Prof. Dr. L. van der Plas, Agricultural University Wageningen
- Ir. P. van der Schans, International Institute for Aerial Survey and Earth Sciences (ITC), Enschede
- Ir. R.P.H.P. van der Schans, Directorate Agricultural Research, Ministry of Agriculture and Fisheries, Wageningen (Chairman)
- Prof. Dr. Ir. T. Wormer (personal member).

Ir. J.B. Ritzema van Ikema resigned as member of the Board in April 1983, after having served on it for many years as representative of the International Institute for Aerial Survey and Earth Sciences (ITC). It is deeply regretted that Mr. Ritzema van Ikema passed away after a long illness on 30 December.

Ir. P. van der Schans was nominated in his place.

9.2 INTERNATIONAL ADVISORY PANEL

The International Advisory Panel (IAP) met in 1967, 1972, 1979 and 1983. The members of the last IAP were:

- Dr. F. Fournier, Division of Ecological Sciences, Unesco, Paris, France
- Dr. H. Ghanem, Institut Agronomique et Vétérinaire, Rabat, Morocco (for Northern Africa)
- Prof. E.G. Hallsworth, IFIAS Save-Our-Soils Project, Brighton, U.K. and past President ISSS (for Australia and ISSS)
- Mr. G.M. Higgins, Land and Water Development Division, FAO, Rome, Italy
- Dr. C.S. Holzhey, USDA Soil Conservation Service, Lincoln, Nebraska, U.S.A. (for North America)
- Dr. M. Jamagne, Service d' Etude des Sols et de la Carte Pédologique de France, Olivet, France (for Western Europe)
- Mr. F.N. Muchena, Kenya Soil Survey, Nairobi, Kenya (for Africa South of the Sahara)
- Dr. A. Osman, Soil Science Division, Arab Centre for the Studies of Arid Zones and Dry Lands (ACSAD), Damascus, Syria (for the Middle East)
- Dr. C.R. Panabokke, Sri Lanka (for South and East Asia): could not attend.
- Dr. C. Valverde, Programa Nacional de Suelos, Lima, Peru; at present International Service for National Agricultural Research (ISNAR), The Hague, The Netherlands (for Latin America and CGIAR institutes)
- Dr. G. Varallyay, Research Institute for Soil Science and Agricultural Chemistry, Budapest, Hungary (for Eastern Europe).

It is deeply regretted that Dr. R.S. Murthy, Director, National Bureau of Soil Survey and Land Use Planning, Nagpur, India, and member of the International Advisory Panel of ISM in 1979, passed away on 4th March 1983. He represented Asia in the IAP.

9.3 NETHERLANDS ADVISORY COUNCIL

Members of the NAC on 31 December 1983 were:

- Ir. J.G. van Alphen, International Institute for Land Reclamation and Improvement, Wageningen
- Dr. J.P. Andriess, Royal Tropical Institute, Amsterdam
- Prof. Dr. Ir. J. Bennema, Department of Soil Science and Geology, Agricultural University Wageningen
- Prof. Dr. Ir. G.H. Bolt, Department of Soils and Fertilizers, Agricultural University Wageningen (Chairman)
- Dr. Ir. J. Bouma, Soil Survey Institute, Wageningen
- Prof. Dr. Ir. A. van Diest, Royal Netherlands Society of Agriculture, Wageningen
- Dr. Ir. P.M. Driessen, Centre for World Food Studies, Amsterdam-Wageningen
- Dr. Ir. J.C. Dijkerman, M.Sc. Course in Soil Science and Water Management, Agricultural University Wageningen
- Dr. Ir. G.W.W. Elbersen, International Institute for Aerial Survey and Earth Sciences (ITC), Enschede
- Ir. J. van der Heide, Institute for Soil Fertility, Haren
- Ir. B. van Heuveln, State University Groningen
- Ir. W.B. Hoogmoed, Soil Tillage Laboratory, Agricultural University Wageningen
- Dr. F. Kadijk, Laboratory for Soil and Crop Testing, Oosterbeek
- Prof. Dr. Ir. F.R. Moormann, State University Utrecht
- Ir. J.C. Pape, Soil Science Society of The Netherlands, Wageningen
- Dr. F.W.T. Penning de Vries, Centre for Agrobiological Research, Wageningen
- Drs. J.F.Th. Schoute, Free University, Amsterdam
- Dr. J. Sevink, University of Amsterdam
- Dr. Ir. P.K.J. van der Voorde, Euroconsult, Arnhem
- Ir. W. van Vuure, Directorate Agricultural Research, Ministry of Agriculture and Fisheries, Wageningen
- Dr. Ir. G.P. Wind, Institute for Land and Water Management Research (ICW), Wageningen.

Mutations

- Dr. Ir. Th. J. Ferrari, Institute for Soil Fertility, Haren, was replaced by Ir. J. van der Heide
- Prof. Dr. Ir. D. Goosen, International Institute for Aerial Survey and Earth Sciences (ITC), Enschede, was replaced by Dr. Ir. G.W.W. Elbersen
- Dr. Ir. J. Schelling, Soil Survey Institute, Wageningen, was replaced by Dr. Ir. J. Bouma
- Prof. Dr. Ir. A.P.A. Vink, University of Amsterdam, was replaced by Dr. J. Sevink.

9.4 ISM STAFF

On December 31, 1983 the ISM staff members were:

Dr. Ir. W.G. Sombroek	: Director, soil classification and correlation, soil ecology
Drs. J.H.V. van Baren	: Curator, documentation
Dr. Ir. L.P. van Reeuwijk, M.Sc	: Soil chemistry, mineralogy and physics
Drs. D. Creutzberg	: Soil micromorphology, educational affairs
Ir. C.A. van Diepen	: Publications, agricultural applications
Ir. A.J. van Dam	: Soil documentation
Ing. R.O. Bleyert	: Soil micromorphology, map documentation
Mr. A.J.M. van Oostrum	: Senior laboratory analyst
Mr. J.R.M. Huting	: Laboratory analyst
Mr. R.A. Smaal	: Laboratory analyst
Mr. W. Bomer	: Monolith preparation, technical services
Mr. W.C.W.A. Bomer	: Technician, photography and drawing
Mr. J.D. Schreiber	: Technician, thin-section preparation
Mr. J. Brussen	: Internal administration*
Mrs. Y.G.L. Karpes-Liem	: Clerical services
Mrs. P.C. van Leeuwen	: Clerical services
Mrs. J.C. Jonker-Verbiesen	: Domestic services
Mrs. J. Nijhuis-Möller	: Domestic services

People working at ISM on a voluntary basis were:

Mr. J.G. ten Bokkel	: Laboratory analyst
Mr. B. van Lagen	: Laboratory analyst
Mr. J.C. van der Straaten	: Laboratory analyst, 1 April till 1 December
Mr. T. Wechgelaar	: Draughtsman

*External administration by Managing Director, ITC, Enschede.

Mutations in 1983

Mr. W. Bomer, technician monolith preparation, retired at the end of the year. He joined ISM on 1 April 1966, three months after its establishment.

Ir. A.J. van Dam, soil documentalist, left at the end of his 18 months' contract.

Dr. O.C. Spaargaren was recruited by ISM as consultant for a fixed term, from 1 April - 15 September.

9.5 GUEST RESEARCHERS

The following soil scientists worked at ISM during 1983 as guest researcher:

- Ir. J.H. Kauffman (since 26 September)
- Dr. C. Mizota (from 1 July to 31 December)
- Drs. M.L. Moura
- Dr. N.M. Pons-Ghitulescu.

Details on their work programmes are given in chapter 4.

**APPENDIX 1 FOURTH MEETING OF THE INTERNATIONAL ADVISORY
PANEL FOR ISM, WAGENINGEN, 13-17 JUNE 1983**

Conclusions and Recommendations

- 1 The Panel recalls that the purpose of ISM is to collect knowledge about the world's main soils and to disseminate this widely. Establishing a collection of soil profiles constitutes the basic element of this work.
The Panel stresses that these activities are of prime importance for developing countries in view of their need to establish national soil reference collections in support of national development actions. ISM is in a unique position to help developing countries create their national reference collections.

- 2 The Panel commends the great effort made by ISM in collecting representative soil monoliths and related information on characteristics, environment, and land use, and recommends that special attention should continue to be given to completion of the soil monolith collection with regard to geographical and taxonomic distribution of the soils of the world, in close cooperation with the national institutions concerned; such collection includes the comprehensive characterization of the profiles and relevant documentation.

- 3 The Panel recognizes the importance of dissemination of information on the work, through the various publications of ISM, and stresses the need to develop this activity by publishing in more than one language and through the agency of a qualified editing service. Consideration may be given to distribution of some of the publications through a commercial publishing house.

- 4.a The Panel, noting the achievement of the LABEX exchange programme, recognizing the importance of standardization of laboratory methods of soil analysis and realizing the pitfalls that may be involved, recommends that ISM continue and expand this programme and invite the participation of additional national laboratories.
Emphasis should be made on better definition of the methods employed and identification of major sources of errors in the particular methods

- b The Panel, noting the growing use being made of the assembled profile data for soil management studies, recommends that ISM should explore the possibilities of collecting more information about soil uses and limitations for use at locations where the monoliths are collected; some fertility-oriented analyses, notably on soil phosphorus, should be included in the laboratory characterization.

- 5.a The Panel endorses the proposal for preparation of a reference collection of thin sections of soils for the ISSS Subcommittee on Soil Micromorphology. It is however stressed that ISM should only be involved in the preparation and distribution of these sections: the actual analysis of these sections to be carried out by the ISSS specialists.

- b The Panel, noting the considerable amount of time spent by the senior micromorphologist on educational duties, recommends that ISM seek additional staff for such educational functions, and so allow more attention to be paid to the micromorphological analysis and interpretation of the soil monoliths.
 - c The Panel, noting the need for, and realizing the importance of, establishing soil micromorphology facilities at national institutions in developing countries, endorses ISM's intention of developing techniques for the use of inexpensive equipment for preparation of thin sections.
- 6.a The Panel, agreeing that ISM may be considered as one of the guardians of the Soil Map of the World efforts, is of the view that the purpose of the ISM soil map collection should be:
- to provide a source for assisting updating the 1:5 million FAO-Unesco Soil Map of the World, both as reference material for any international efforts to compile a 1:1 million soil map of the world, and
 - to provide background information for the soil monolith collection.
- The Panel further agrees that the following types of soil maps should be actively collected:
- generalized soil maps, at scales of 1:1 million and smaller, for regional and global correlation work;
 - small-scale soil maps, at scales of 1:250,000 and smaller, for each country;
 - typical examples of large scale maps as being compiled in different countries, together with corresponding national index maps or lists.
- b The Panel agrees on the proposal for the computerization of the ISM map catalogue, provided additional funding becomes available for this purpose.
- 7 The Panel, alarmed at the very large proportion of the ISM staff's time taken up by "educational activities", to the detriment of the time spent on the main tasks of ISM, i.e. the proper characterization of the monolith collection, recommends that alternative provisions be sought to deal with group visits.
- 8.a The Panel commends ISM on the annual training course provided to intending curators of soil monolith collections in developing countries, and recommends that appropriate steps be taken to allow the course capacity to be doubled to 10 candidates at a time.
- b The Panel considers the ISM backstopping, which supports the setting up and utilization of national soil reference collections in developing countries, as a most important activity, and encourages a search for additional funds for this purpose.
- 9.a The Panel recommends that ISM install a computerized data base for storage and analysis of pedologic, climatic, cartographic, and agronomic information related to each of the soil monoliths of the collection.

- b The Panel recommends that ISM seek advice on the advantages of establishing a soil cartographic information file, in cooperation with appropriate national and international centres.
- 10 The Panel, commending ISM on the attempts to establish the soil-related land qualities of each soil monolith that is representative of a unit of the FAO-Unesco Soil Map of the World, recommends that this work be continued and expanded, taking particular note of the constraints to plant growth indicated by soil profile characteristics.
 - 11 The Panel, acknowledging that ISM should participate in international efforts on the correlation and improvement of existing soil classification systems, suggests that the following activities in this field should be undertaken as funds become available:
 - cooperation in the development of an International Reference Base for soil classification;
 - cooperation in the improvement and updating of definitions of classification and mapping units, leading toward quantitative characterization;
 - promotion of accurate, comprehensive and standardized soil descriptions and laboratory analyses.
 - 12.a The Panel agrees that, for the present, ISM should restrict its collection of miscellaneous soil materials to those needed for research purposes within ISM.
 - b The Panel, considering that soil formation in tropical conditions often extends to great depths, recommends that ISM establish an international reference collection of deep weathering profiles. The IGCP-Unesco Project 129 proposal, to establish an international Interdisciplinary Collection of Reference Laterite Profiles at ISM, fits into this activity.
 - 13.a The Panel agrees with the present policy of ISM on guest researchers, namely concentration on the study of main groups of soils and on the preparation of Soil Monolith Papers. Such research workers may also contribute to other ISM publications (Technical Papers, Monographs) or may help to fill gaps in any other regular ISM programme.
 - b The Panel suggests that ISM stimulate experienced soil scientists to take an active part in ISM's work as guest researchers: additional funds should be sought for research fellows from non-OECD countries.
 - 14 The Panel, aware of the increasing hazard of degradation of natural resources and recognizing the importance of the soil component in Biosphere Reserves and other MAB sites, considers that the current involvement of ISM in this work, by means of backstopping activities to monitor and investigate changes, be continued and further developed. The Panel recommends that special financial resources be allocated to ISM-Unesco/MAB for such work in developing countries, and that more attention be given to the collection of soil monoliths from MAB areas.

- 15.a The Panel appreciates the activity of ISM in the development of international contacts. The Panel proposes that steps be taken to enlarge and strengthen these relations which are key prerequisites for the success of future ISM work. Special attention should be paid to the establishment of good cooperation between ISM and the proposed IBSRAM entity for the promotion of management-oriented soil research in the tropics.
- b The Panel believes that ISM has to be a centre of documentary information. The Panel agrees and emphasizes that provision of supplementary international funding is of special importance for the future of ISM; contacts are suggested with agencies which might provide such funding (e.g. UN specialized agencies, UNDP, UNOTC, UNCSTD, and others).
- 16.a The Panel received the briefing paper, prepared by the Director, on the possibility of creating an ISM Foundation with a board comprising representatives of closely associated Dutch institutions and international groups. It considers that there should be international representation, including ISSS, on any Foundation board, but such representation might have to be designated as liaisons officers, to conform with requirements of Dutch law.
- The consensus of the Panel is that such a Foundation would not conflict with any working arrangements known to the Panel. Further support from Unesco or any support from FAO and other UN agencies to such a Foundation would be subject to the decisions of appropriate Governing Bodies of these organizations.
- The Panel encourages ISM either to pursue formalization efforts, or to continue on the present course, in the way that the provisional Dutch Board and the ISM Staff feel would be best to help accomplish ISM's goals.
- b Alternative names for ISM were considered by the Panel. The following concepts were agreed:
- the presently employed word "Museum" is too restrictive and not sufficiently dynamic for the ISM programme;
 - any new name should be as connotative as possible in order to limit misunderstanding as to the scope of the organization.

To meet these requirements the Panel suggests the following new name: International Soil Reference and Information Centre (ISRIC), with as subtitle: "a centre for collection and study of soil reference materials" (formerly known as the International Soil Museum).

APPENDIX 2 GROUP VISITS IN 1983

Professional - national

Institutions:	Approximate number of persons:
Free University Amsterdam	15
University of Amsterdam	2 visits of 20
Delft University of Technology	15
College of Agriculture, Den Bosch	20
National Agricultural College, Deventer	2 visits of 40
State University Groningen	50
Teacher College, Groningen	15
School of Agriculture and Horticulture, Kerk Awezaath	30
State University Utrecht	2 visits of 30
College of Forestry and Land and Water Management, Velp	20
Agricultural University Wageningen	14 visits of 20

Professional - international

<i>Belgium</i>	
International Training Course, Ghent	28
<i>Czechoslovakia</i>	
University of Nitow	15
<i>Denmark</i>	
University of Copenhagen	10
<i>England</i>	
Portsmouth Polytechnic	9
<i>France</i>	
Laboratoire Science de Sol, Rennes	12
<i>Fed. Rep. of Germany</i>	
University of Aachen	30
Fachhochschule of Bochum	12
University of Bonn	21
University of Hamburg	25
University of Kiel	20
Fachhochschule of Osnabrück	21
<i>Japan</i>	
National Federation of Agriculture Co-operative Associations (Zen-NOH)	24
<i>The Netherlands</i>	
International Course for Environmental Sciences and Technology, Delft	15
International Institute for Aerial Survey and Earth Sciences (ITC), Enschede	30
Agromisa international course, Wageningen	14
EC Seminar on Land Evaluation, Wageningen	16
International Advisory Panel of ISM, Wageningen	9
International Course for Development Oriented Research in Agriculture (ICRA), Wageningen	2 visits of 20
International Course for Land Drainage, Wageningen	25
M.Sc. Course in Soil Science and Water Management, Wageningen	6 visits of 20
<i>Sweden</i>	
University of Uppsala	10

Non-professional

Sapporo TV Broadcasting Tour, Japan	19
Agricultural University Wageningen	30
School for Analysts (STOVA), Wageningen	11

REQUEST FOR MAPS AND REPORTS ON SOIL RESOURCES

Cartographic materials form an important part of ISRIC's documentation section. Geographic coverage of the collection is the whole world with emphasis on developing countries. The subject emphasis is on soils, but related geographic information on climate, ecology, vegetation, land use, land capability, geology, geomorphology, etc. is also of importance to the collection.

The acquisition policy is to obtain world coverage of maps at reconnaissance and smaller scale; examples of more detailed maps and index maps/lists of soil and related surveys carried out in a country. The selection criteria are relevance of the maps for soil science, agricultural development and environmental issues.

The major purpose of maintaining and enlarging the map collection at ISRIC is its use for the possible updating of the FAO-Unesco Soil Map of the World at scale 1:5 million and the compilation of a new, computerized world soil map at 1:1 million. The map collection serves also as a source of basic information for scientists and students using ISRIC's facilities for guest research or training.

You are kindly requested to send maps and accompanying reports,

of the types indicated above, either:

- directly to ISRIC, P.O.Box 353, 6700 AJ Wageningen, The Netherlands;
- through the Dutch Embassy or Consulate in your country;
- or through the Regional Offices of Unesco and FAO.

