

THE DATA BANK OF PALYNOLOGICAL SPECIES DESCRIPTIONS AT LEIDEN

J.H. GERMERAAD¹⁾

SUMMARY

The present state of the palynological data bank at Leiden is described, the problems, as yet partly unsolved, are explained and suggestions are given to improve the input procedure.

STATE OF AFFAIRS AND REQUIREMENTS
FOR GROWTH

Ever since in 1970 the establishment of a palynological data bank of species descriptions was initiated in the Rijksmuseum van Geologie en Mineralogie at Leiden (Germeraad & Muller, 1970), its realization was progressing steadily. In the present phase the data input consists mainly of descriptions of recently published new species. To gain the necessary experience as widely and quickly as possible, those publications dealing with different morphological groups have been chosen: spores and pollen with complex features, among which bisaccates and polyads. In this way the problems met in codifying various types of characteristics could be dealt with in an early phase. This resulted in the extension of the "manual" for numerical coding (Germeraad & Muller, 1971). The chapter on the codification of the position of units could, for example, be enlarged recently with more than 40 sheets.

Improvement of input

It is beyond doubt that the input of data in the data bank can be facilitated considerably if in future all new species descriptions will be accompanied by schematic drawings of fields and units. A first example of such an improved description was given by Muller (Muller, 1973: 38-40). In these drawings the fields and units of each layer are indicated with numbers allowing direct references from the text to the sketches. In this way it is avoided that the coder has to read the description several times in close comparison with the illustration(s) and that in spite of all these efforts it remains uncertain which feature(s) the author of the species descrip-

tion actually saw and where. The recommended sketches may also lead to a more consistent annotation of dimensions, which in many descriptions are often partly or completely lacking and occasionally are replaced by vague indications like large(r) or thick(er). It is admitted that a diameter of less than one micron lacks precision when measured under ordinary working conditions, including oil immersion, but in relation to an estimated width of another minute feature both estimated figures can make sense.

It is not suggested to make sketches of the field distribution of each species; for groups of species with a similar pattern of fields one set of sketches will suffice.

Types of descriptions

The data input consists of different types of descriptions. In many cases the description concerns an entirely new species and for its definition a type specimen had been chosen. Other descriptions, however, are based on populations of individuals assumed to belong to one species; therefore the description is sometimes biased to a certain extent. This information should be incorporated into the data input, especially so as the species may be heteromorphous. A second group of descriptions is formed by the species definitions re-formulated either by the original author or by someone else. In principle it should be clear to the coder to which of the following types the description belongs:

- 1) the original description of the type specimen,
- 2) the original description of a population of individuals considered to belong to one species,
- 3) a revised description of the type specimen re-formulated by the original author,
- 4) a revised description of a population of individuals considered to belong to one species re-formulated by the original author,
- 5) a revised description of the type-specimen re-formulated by someone else,
- 6) a revised description of a population of individuals considered to belong to one species re-formulated by someone else,
- 7) the description of a paratype specimen,
- 8) the description of a paratype population,
- 9) the description of a variant in a heteromorphous species.

¹⁾ Rijksmuseum van Geologie en Mineralogie, Hooglandse Kerkgracht 17, Leiden, The Netherlands.

A new description may replace an old one only in case the definition belongs to the same type and is formulated by the same person who specifically withdraws the older definition. In all other cases new descriptions cannot replace old ones and should enter the data bank separately if they are worth to be recorded (G e r m e r a a d, 1973).

It should be kept in mind, that the description of a species as given in the (original) publication is accepted as such by the Registration Centre. Any other palynologist may have seen more or different features, either by using another type of microscope, or preparation method, or due to his different (occasionally greater) experience. But for the coder this is of no concern. The only thing he desires is to interpret the description precisely as the original author intended. He is not allowed to alter the description according to his own ideas, but he may add information, e.g. observed in the illustrations but not recorded by the author in the written description. This addition should be clearly separated from the original description. In such cases it may be preferable that the original author or the type specimen is consulted before the coded description enters the data bank. If topo- or paratypes are consulted, this should be recorded too.

Retrieval of alphameric data

The programming necessary for the mechanical data processing was already well under way when the "Manual" was printed. However, at that time a data bank of geological collections at Leiden (G e r m e r a a d, F r e u d e n t h a l, v a n d e n B o o g a a r d & A r p s, 1972) was established and with its completion many improvements of programming became available and were incorporated into the programmes for the palynological data bank, i.a. the retrieval of alphameric data. The improved basic programme resulted in considerably faster and cheaper programming, but this is mainly of financial interest to the average palynologist.

Two advantages are apparent:

- 1) the possibility of retrieval of species descriptions selected on species names, terms or other types of words;
- 2) a much cheaper retrieval of species descriptions selected on a specific morphological feature for which a standardized term is generally accepted, which feature is coded numerically in a complex way (i.e. in more than one module).

An additional benefit is obvious in those cases where the feature cannot be coded easily or properly, in spite of the fact that the feature exists beyond doubt. A retrieval is then still possible on the term, provided this term was incorporated in the alphameric data of the species description.

Towards a standardization of terms

In view of the advantages mentioned above new efforts are now being made to establish a worldwide acceptable dictionary of terms. Since SEM and TEM descriptions are becoming more and more divergent in terminology used, a standardization of terms is highly urgent. When coining new terms it should be kept in mind that the meaning of words in

modern languages tends to change in time (quite normal in 'living' languages). Moreover a new term like "rice-husks" (Smit, 1973) may be used in different ways, e.g. for hollow and for massive structures; some words are only locally in use and therefore other workers may be unfamiliar with the meaning of these terms. Probably the use of such terms may sooner or later lead to unnecessary confusion. In this respect the use of classic languages has a great advantage, as the meaning of such terms is basically more stable. Latin and Greek, although preferable in principle, already have been exhaustively used for coining terms for certain closely related features. A switch to other classic languages (e.g. sanskrit) might even be considered.

As stated above, a dictionary of terms which will be adopted and accepted by all palynologists appears to be highly urgent. This requires the establishment, in due course, of a working group on terminology which should have the full backing-up of the "International Commission for Palynology" (ICP). To this purpose S. Nilsson (Stockholm) has despatched a circular to a great number of palynologists all over the globe. As a result of this appeal it is hoped to form an international working group that will develop a feasible method to get worldwide acceptance of the standardization of terms.

International co-operation

To-day the importance of worldwide contacts between palynologists on behalf of data banking is generally recognized. A very good co-operation is being worked out with many palynologists in France and Belgium. Once this co-operation will be functionally well-established, the network of co-operation will gradually be extended to other countries. The building up of such a network has been discussed already during the session of palynologists in Tucson in October 1971, organized with inspiring enthusiasm by G.O.W. Kremp (K r e m p, 1972). The problems which show up, when establishing an international network, originate mainly from the inequality of the contributions to the data bank, of the data exchanged to other data banks, and of the possibilities of the institutions to give something compensating in return.

In principle it seems fair, that something ought to be worked out to the benefit of all. Unfortunately not all institutions concerned have the freedom to exchange data for money, which means that only barter agreements may be attractive in those cases. It appears likely that some institutions have little of interest to offer for barter. These problems concerning the exchange of data are so essential that an International Palynological Data Bank Consortium (IPDBC), as proposed in Tucson, will probably be the best platform to have them solved, be it that at this very moment this has not been realized and therefore little can be done (K r e m p, 1972). In the near future a new questionnaire will be necessary in which all possible co-operating institutions may bring forward on what terms and under what conditions any exchange of data will be feasible for them. The resulting agreements, however, will have little to do with any scheme

that will have to be established by each individual Registration Centre to organize the use of its data bank by the various types of "customers" (scholars, students, institutions) as this is a "local" and not an international problem.

A DICTIONARY OF STANDARDIZED PALYNOLOGICAL TERMS

A first contribution to this project may not be entirely out of place here. In the past, unfortunately, not all palynological terms were properly defined and not all terms were uniformly used. Although this is well-known (K r e m p, 1965), it still may be useful to give some examples picked from the 3000 definitions gathered from the available literature by H.P. Fuchs (Chur, Switzerland) and the author (Table 1).

When formulating the definition of a term, it should be made clear to the reader whether that term covers one or more aspects of morphology. Also the definition should express that the term is exclusively used in relation with other features, or that it specifically denies the existence of such a relationship (Table 2). Some terms are only used for certain groups of sporomorphae and this should be stated in the definition too. If this information is incomplete or absent in any existing definition, a revision of it is urgently required to avoid further confusion and to obtain general acceptance of the term.

Table I Examples of terms used in different ways as found in literature.

reticulate

- 1) forming a network
- 2) ditto, but lumina generally smaller than in lophate grains
- 3) ditto, but the muri generally lower than in lophate grains
- 4) ditto, lumina wider than muri
- 5) ditto in relation with lumina
- 6) ditto with small lumina
- 7) ditto, ektexinous
- 8) ditto with brochi larger than 1 micron

tectate

- 1) the ektexine forms another membrane outside the endexine
- 2) ditto, but in some relation with columellae
- 3) ditto, covering at least 80% of the surface of the grain
- 4) a combination of 2) and 3)
- 5) a combination of 2) and 3) but thick
- 6) the rays of a trilete spore

annulate

- 1) exine area immediately surrounding a pore and differing from the general surface of the grain
- 2) ditto, but differing in the ektexine only
- 3) protruding rim or ridge encircling the pollen grain or spore (not a pore)

Table II Some palynological terms and their morphological aspects. In this table terms are listed and grouped according to their defined morphological meaning (according to at least some palynologists). In several cases, however, undefined, often variable relationships with other morphological features of the grain are obvious.

| term | aspect of morphology | relationship with other parts of the grain |
|---|-------------------------------------|--|
| polar, equatorial | position | |
| distal, proximal, endexine, ektexine, tectum, iso- or heteropolar | position | exists |
| circular, oval | shape | |
| aperture, sulcus, scar, furrow, pore | shape | exists |
| small, large, micro-sporopollenin | size | |
| linear, spirally | wall material | |
| radially | pattern | |
| centro-symmetrically | direction | |
| centre (of pattern) in X | centre | exists |
| oblate, prolate | position+shape | |
| syncolpate, peri-dispersed | position+pattern | |
| polar cap, airsac, vestibulum, transverse furrow, intercolpium, operculum | position+pattern | exists |
| striate | shape+pattern | |
| trilete, columellate, cingulum, muri, lumen | position+shape+pattern | |
| intrabaculate, margo, annulus, heterocolpate | position+shape+pattern | exists |
| brevicolpate | position+size+pattern | exists |
| croton-pattern | position+shape+pattern+centre | exists |
| arcuate | position+shape+pattern+direction | exists |
| perforate, foveolate, fossulate, reticulate | position+shape+size+pattern+density | |
| dyad, triad, tetrad, polyad, pollinium | pattern+direction | |

REFERENCES

- Germeraad, J.H. (1973) – Data banking ten behoeve van Informatie-overdracht in de wetenschap. Universitas Belgica Communication No 55, p. 47-53.
- Germeraad, J.H. & J. Muller (1970) – A computer-based numerical coding system for the description of pollen grains and spores. *Rev. Palaeobotan. Palynol.* 10, p. 175-202.
- (1971) – Ditto Manual, Vol. I & II + Suppl. 1 Febr. 1974. Rijksmuseum van Geologie en Mineralogie, Leiden, The Netherlands.
- (1973) – A proposal for a computer-based numerical coding system for the description of pollen grains and spores. *Proceedings of the IIIrd International Palynological Conference. Acad. Sciences, Institute of Geography, Moscow*, p. 77-80.
- Germeraad, J.H., M. Freudenthal, M. van den Boogaard & C.E.S. Arps (1972) – A computer-based registration system for geological collections. *Scripta Geologica* 9, p. 1-12.

- Kremp, G.O.W. (1965) – Morphologic encyclopedia of palynology. Univ. Arizona Press, Tucson, Ariz., 263 pp.
 — (1972) – Paleo data banks Newsletter. Department of Geosciences, Univ. Ariz., nr. 3.

- Muller, J. (1973) – Pollen morphology of *Barringtonia calyptrocalyx* K.Sch. (Lecythidaceae). Grana 13, p. 29-44, 6 plts. 3 figs.
 Smit, A. (1973) – A scanning electron microscopical study of the pollen morphology in the genus *Quercus*. Acta Botan. Neerl. 22 (6), p. 55-65.

LETTER TO THE EDITOR

Is there any evidence that the inclination of the rotation-axis of the earth is subject to change?

Palaeontological evidence exists that in past geological times the tropical belt has been much wider than it is now. For instance the jurassic tropical floras and faunas were distributed between 50° – 60° on either side of the equator. In eocene time a tropical forest has been present in Alaska, and according to the latest palaeomagnetic evidence Alaska was situated in that time at a latitude of more than 60° . The broad-leafed forest of Alaska not only must have lived in a climate that is substantially warmer than the present climate. Even a warmer climate would not be enough for the development of a tropical forest in that area. But also at a latitude of 60° or higher, the short winterdays would not provide sufficient hours of daylight. As far as I know, Wolfe (1969) has been the first to suggest that in the past the inclination of the rotation axis of the earth has not been the same as it is nowadays. A situation at which the inclination of the rotation axis is (nearly) zero must have had an incredible influence on the vegetation of the earth. When the sun stands above the equator the whole year round, there are no

seasons. And the absence of seasons, and therefore of a physiological dry period, makes that there is no need for plants to develop deciduous leaves – and in Alaska the trees were evergreen. An other result is that in favourable conditions, the night temperature never comes below zero at much higher latitude than nowadays.

In the northern hemisphere a SW passat would have been the prevailing wind at the west side of the continents. The conditions would be those of the equable climate that is suggested for the earth on account of the vegetation in several periods of the earth history. The problem is that I could not find any indication in the literature regarding the position of the rotation axis during the earth's history. Therefore I ask the reader whether he ever came across any geological or geophysical evidence in this matter. Please write to:

Drs. H.P. Nooteboom, Lab. v. Exp. Plantensystematiek der Rijksuniversiteit, 5e Binnenvestgracht 8, Leiden.

Wolfe, J.A. (1969) – Paleogene floras from the gulf of Alaska region. U.S. Geol. Survey, Open-file report.