

Publishing in paleontology

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SUMMARY

The structure of palaeontological publishing depends basically on the facts that palaeontology (a) represents a very wide subject span but employs relatively few specialists, (b) needs both massive idiographic representation and an increasing proportion of nomothetical discussion, and (c) is divided between the earth and life sciences. Publication still largely takes place in old-fashioned mixed-subject serials, and palaeontologists are only slowly becoming aware of the necessity of structuring presentation and channelling the results of research. Symposium volumes greatly contribute to the deterioration of palaeontological publishing by inefficient circulation, the withholding of manuscripts from quality control and the withholding of articles from availability through the secondary services. Inefficient publication is admirably compensated by reprint circulation, catalysed by directories and newsletters. Synoptic publication provides a solution to the imminent economic problems of idiographic palaeontology but does not gain ground. The burial of idiographic palaeontology in the «grey literature» is not yet disturbing. The lowering of formal requirements in school education displays repercussions in language, style, terminology and nomenclature. Internationalism is gaining ground but must be further promoted. Idiographic palaeontology will be slower than most natural sciences in becoming adapted from paper media to microforms and electronic communication, owing to the need for good illustrations and simultaneous comparison, lack of procedures for the handling of successively updated material and the requirements of the codes of biological nomenclature.

RESUMEN

La estructura de la publicación paleontológica depende básicamente del hecho de que la Paleontología a) representa un tema muy amplio pero emplea relativamente pocos especialistas, b) necesita tanto representación ideográfica masiva como un aumento proporcional de discusión nomotética y c) está dividida entre las ciencias de la tierra y de la vida. La publicación se lleva aún a cabo a través de series anticuadas que incluyen temas variados, y los paleontólogos empiezan lentamente a comprender la necesidad de una presentación estructurada y de la canalización de los resultados de la investigación. Los volúmenes de Simposios contribuyen considerablemente al deterioro de la publicación de la Paleontología debido a su insuficiente circulación, al inadecuado control de calidad y a la insuficiente accesibilidad a los artículos a través de servicios secundarios. La divulgación insuficiente es, no obstante, admirablemente compensada a través de la circulación de separatas canalizada por catálogos y noticiarios. La publicación sinóptica ofrece una solución inminente al problema económico de la Paleontología ideográfica, pero no gana terreno. No obstante, el enterramiento de la Paleontología ideográfica en la «literatura gris» aún no ha finalizado. La disminución de las exigencias de la educación escolar acarrea repercusiones en el estilo literario, la terminología y la nomenclatura. El internacionalismo gana terreno y ha de ser promovido. La Paleontología ideográfica avanzará más lentamente que otras ramas de las Ciencias Naturales en la adaptación de la impresión en papel a las microfichas y a la comunicación electrónica. Esto es debido a la necesidad inherente de ilustraciones adecuadas y de comparación simultánea, e igualmente a la falta de procedimientos para el tratamiento del material sucesivamente modernizado y de las exigencias de códigos de nomenclatura biológica.

RESUM

L'estructura de la publicació paleontològica depèn bàsicament del fet que la Paleontologia: a) representa un tema molt ampli però s'hi dediquen relativament pocs especialistes, b) necessita tant de representació ideogràfica massiva com d'un augment proporcional de discussió nomotètica i c) està dividida entre les ciències de la terra i de la vida. La publicació encara es duu a terme mitjançant sèries antiquades les quals inclouen temes variats, i els paleontòlegs comencen lentament a comprendre la necessitat d'una presentació estructurada i de la canalització dels resultats de la investigació. Els volums de simposis contribueixen considerablement al deteriorament de la divulgació de la Paleontologia, mitjançant publicacions degut a llur ineficient circulació, l'inadequat control de qualitat i la insuficient accesibilitat als articles a través de serveis secundaris. La divulgació insuficient és, tanmateix, admirablement compensada per la circulació de separates canalitzada per catàlegs i noticiaris. La publicació sinòptica ofereix una solució a l'imminent problema econòmic de la Paleontologia ideogràfica, però no guanya terreny. Tanmateix, l'enterrament de la Paleontologia ideogràfica dintre la «literatura gris» encara no ha acabat. La disminució de les exigències de l'educació escolar reporta repercussions en l'estil literari, la terminologia i la nomenclatura. L'internacionalisme guanya terreny i ha d'ésser promogut. La Paleontologia ideogràfica avançarà més lentament que altres branques de les ciències naturals en l'adaptació de la impressió en paper a les microfiches i a la comunicació electrònica. Això és degut a la necessitat inherent d'il·lustracions adequades i de comparació simultània i, igualment, a la manca de procediments per al tractament del material successivament modernitzat i a les exigències dels codis de nomenclatura biològica.

In this survey of publishing in palaeontology I am not going to aim at descriptive completeness or any kind of quantitative evaluation of the field, bibliometric or otherwise scientometric. This should be done some time, of course, perhaps by a fully professional information scientist rather than a palaeontologist who tries to linger in active research and some teaching. I am convinced that such a study would produce results quite different from those in the well-populated hard sciences which have hitherto attracted practically all attention of this kind.

I would rather try to concentrate on the concept-and-method aspect of the subject, in accordance with the title of the present symposium. This means analysing the peculiarities of our field of publishing, identifying our strategies for communicating results in publications and finding out how we manage in a time of rapidly changing technology. In particular I would like to stress methodological aspects of the production of publications — writing, editing and structuring, up to the level of the publisher's decisions. On the whole the

field is neglected to such an extent that I have to allow myself an unusual number of self-citations when trying to synthesize a number of contributions in the not too grey literature. Real methodology is hardly displayed in style-manuals, published house-rules or standards. To tell authors and editors how to act according to conventions is not *methodology*. We must analyze how these conventions originated, historically and against the background of available technology, and study how they can be developed under existing and new conditions.

Describing three types of citation — reference relations established in scientific publications is not methodology. We must test each system with regard to economy, techniques and above all the *ergonomics* of reading and writing texts with citations and quotations. Defining the main types of serial publications is not methodology. We must, for example, identify the minimum number of types necessary for an optimal *strategy* in channelling our results to those who will apply them practically or use them in the continued development of science. The editor is confronted with hundreds of

A Euryhalinity of Palaeozoic articulate brachiopods

B FRANZ THEODOR FÜRSICH AND JOHN MALCOLM HURST

G LEITHAIA **C** Fürsich, Franz T. & Hurst, John M. 1980 10 15: Euryhalinity of Palaeozoic articulate brachiopods. *Leithaia*, Vol. 13, pp. 303–312. Oslo. ISSN 0024-1164.



D Monotypic and very low diversity virgianid shell beds from the Upper Ordovician to Lower Silurian dolomites of North Greenland were formed in marginal marine quiet-water hypersaline environments. In the light of this evidence the salinity tolerances of other Palaeozoic articulate brachiopods is evaluated. There are only a small number of species apparently invading hypersaline or brackish environments, but it is significant considering that previously all articulate brachiopods were thought to be fully marine. Two types of occurrence are noted, those species specifically related to marginally marine environments, disappearing with the introduction of fully marine faunas, and the majority of species which extend their normal marine range into marginal conditions. No brachiopod species appears to have invaded very hypersaline or truly brackish conditions. No single group of articulate brachiopods specifically specialised in colonising marginal marine environments, apart from possibly the virgianid pentamerids.

E Palaeozoic, Upper Ordovician, Lower Silurian, Brachiopoda, Pentamerida, Virgianida, Greenland, palaeoecology, hypersaline environments, brackish environments.

F Franz Theodor Fürsich, Institut für Paläontologie und historische Geologie, Richard-Wagner-Strasse 10/II, D-8000 München, Germany; John Malcolm Hurst, Grønlands Geologiske Undersøgelse, Øster Voldgade 10, DK-1350 København, Denmark; 3rd June, 1980.

Articulate brachiopods are normally assumed to be stenohaline and fully marine (e.g. Rudwick 1970:158; most standard texts as Barnes 1974:717; Tasch 1973:263) and are therefore taken as important environmental indicators. This is probably the result of both their present-day distribution and the fact that the majority of fossil forms are associated with diverse marine faunas only.

We believe the assumption that the vast majority of Palaeozoic articulate brachiopods always indicate fully marine conditions questionable. The following reasons (1) to (5) (see also these terms). Our primary evidence is based on data from the Lower Palaeozoic successions of North Greenland. In the light of this evidence we re-interpret previously published data on articulate brachiopod distributions throughout the Palaeozoic.

Recognition of ancient hypersaline or brackish shell beds from the literature is hampered, as:

- (1) The facies context of most fossils is poorly understood by most palaeontologists. Conversely, sedimentary facies often lack detailed data on faunal occurrences.
- (2) Fully marine brachiopods are often found in brackish environments.

Fig. 1. This article-head embodies some of the more important innovations in the format of journal articles in palaeontology and related sciences in order to make it easy (1) to cite the article correctly in text and formulate the corresponding correct reference, (2) to abstract and index the article in the secondary systems, (3) to catalogue it, (4) to make offprints with a minimum of labour investment and without loss or addition of bibliographical information, and (5) to order the full publication from libraries and book-shops.

□ A. The article title. Short article titles are made possible by the nearby presence of an abstract and keywords containing supplementary title information. □ B. Authors' names. Giving bibliographic information in upper case means concealing important information on capital letters, French accents, etc., to be used in normal lower-case text (in names like ZoBell, de la Ferté, De Geer, MacGregor, Macgregor, etc., and in terms like Trilobites ordoviciens, Ordovicien supérieur, Lower Ordovician, etc.). Giving more than one first name in full is not common. □ C. Biblid adjusted for use in the name-and-year system. The supplementation of month and day should ideally reflect the actual date of publication. For the reasons given under B, it is important to provide the biblid in lower case; the biblid is formulated as a reference corresponding to citations of the article. Items C-E can be transferred to a normal 125 × 75 mm documentation card. Repetition of the title and author's names is necessary for the reasons and functions stated. □ D. Informative abstract. □ E. Keywords, in this case according to a free vocabulary, forming an indicative supplement to the abstract. □ F. Authors' addresses in the most functional place, automatically accompanying copies of the abstract for card-files, etc. The date of submission has the practical function of indicating the date up to which the citations and references in the article should cover earlier literature. Dates on the administrative handling of the manuscript (receipt, acceptance, printing) are redundant. □ G. The logotype here replaces the practical identification effect of an ornamented or otherwise characteristic cover. Streamlined production and subsequent handling of offprints require the articles to start on *recto* pages.

problems of the former magnitude and the publisher with dozens of the latter. There are almost as many immature or outdated solutions as there are problems, and these are presented to the author, the least professional partner, in the form of house-rules for each individual publication. The author becomes confused, and since there is no methodological discussion, he tends to follow the first instructions he was given, or the last, or the loudest, depending on his personality. This individualism or parochialism is irrational and enormously expensive, if all adaptive processes, delays and mistakes are considered. The subject is general and large enough for a handbook, but let us keep as close as possible to the given subject, *la divulgación de la Paleontología*.

A WIDE SUBJECT WITH DISPERSED PRACTITIONERS

It is typical of palaeontology that it spans practically all the earth and life sciences. It is not a subdivision of them—it is a general approach. You can subdivide and classify palaeontology, however, and also add a number of subordinate general approaches. Subdivision takes place in three dimensions, according to the biological system, geographical distribution and stratigraphical range. This is one dimension more than in biology, and that is a lot. If one adds subordinate approaches, such as micropalaeontology, palaeoecology, biostratigraphy, etc., one arrives at a multidimensional framework of specialization. Under «geographical distribution» the national responsibilities and identities of the palaeontologists would have a greater impact on publishing structure than geographical properties inherent in the field of science treated.

Although palaeontologists are distinctly less numerous than physicists, chemists and neontologists, one would expect at least some of the specializations to be sufficiently well-represented to have an impact on the structure of publishing, in the same way as in other fields. However, by 1950 there were only two national journals proper specializing in the whole subject of palaeontology. There were no international journals for palaeontology or parts of the subject, although the *Journal of Paleontology* (from 1926) played a largely international role and the *Paläontologische Zeitschrift* (from 1914) as well as the society behind it aim at the German-speaking palaeontological community rather than a national identity. There were more numerous monograph and memoir series, largely on a national basis and published by learned societies, geological surveys, museums and other institutions, which carried the word «palaeontology» in their title. The archival approach was very prominent in palaeontological publishing, and it was typical of the journals, too, that articles on the ideas and methods of palaeontology were tucked in among massive descriptions of floras and faunas or even included in them as subordinate components.

The bulk of palaeontology, however, was published in the mixed series of learned societies or in the serials pertaining to the «paternal sciences» of palaeontology. At a very early stage a characteristic tripartition originated, with invertebrate palaeontology and stratigraphically applied aspects (including most micropalaeontology) appearing as «geology», vertebrate palaeontology as «zoology» and palaeobotany as «botany».

1950 is a convenient year to use as a base for comparisons, between the first recovery from the greatest world crisis in history and the full realization of the research explosion under

way. Within a decade the number of notable national journals had tripled, including *Palaeontology* in the United Kingdom (1957), *Paleontologicheskij zhurnal* (1959; translated almost cover-to-cover since 1967 as the *Paleontological Journal*), *Acta Palaeontologica Polonica* (1955) and *Acta Palaeontologica Sinica* (1952). Micropalaeontology was the first subordinate approach to palaeontology to be provided with special journals, in the form of *Micropaleontology* (1954) and *Revue de Micropaléontologie* (1958). *Vertebrata Palasiatica* represented a fairly unique type of palaeontological journal during this epoch. A special niche among the serials was taken by *Senckenbergiana Lethaea*, issued as a journal but with an explicit programme for publishing idiographical palaeontology as defined just below.

IDIOGRAPHICAL AND NOMOTHEtical PALAEONTOLOGY

Distinguishing between material of national and international interest and between different major branches and approaches would, then, be a natural basis for *structuring* palaeontological publishing and *channelling* the results to the right user (Martinsson, 1969). However, two antithetic aspects of quite a different kind are decisive for all rational development of publications in this respect.

In an academic address Schindewolf (1964) drew attention to the fact that earth history may be approached under *idiographical* and *nomothetical* aspects in the same way as political history. The former concept stands for the description of phenomena, circumstances and events, the latter for the continuing reconstruction of the «laws» of nature and culture or the lines of thought within science. There is probably no field in which these fundamental aspects and approaches are of such a concrete and essential importance as in scientific publishing (Martinsson, 1965, 1969). Within the natural sciences, the need for combination of these approaches is typical of the earth and life sciences, in both cases with more purely nomothetical flanks (Martinsson, 1981). Palaeontology is an extreme example of how the channelling of the two kinds of information should be differentiated. Recently, Gould (1980) has reviewed palaeobiology as a «nomothetic, evolutionary discipline». What does all this theory mean in practice and in publishing?

Nomothetical documents are usually short, of immediate international interest and with a short lifetime as independently cited publications before they are integrated with the general knowledge in handbooks and textbooks. Idiographical documents are often very voluminous, cited and quoted quite as much as the nomothetical ones, but the citations are spread over centuries. Idiographical documents generally require very generous illustrations, sometimes applying special techniques, whilst some graphical synthesis is often sufficient to accompany the text of a nomothetical document. Nomothetical documents are practically always suitable for integration as articles in a regularly appearing journal, budgeted for a certain number of pages within a volume or year, but longer and complicated idiographical documents must often be budgeted and scheduled individually. The sales structure, attractiveness to publishers and need of subsidies are quite different for publications of the two categories, the disadvantages generally affecting the idiographical ones which sell slowly and cannot reasonably be bought complete or on standing subscriptions by individuals. As will be further elaborated below, the typical vehicle for the idiographical

material is the monograph or memoir series, whilst the nomothetical material can always be placed in journals proper (periodicals).

It is meaningless to be dogmatic or completely puristic about the distinction between idiographical and nomothetical material, but it is certain that lack of recognition of this distinction is largely responsible for the deficiencies in both the authors' strategies and the administrators' policies in palaeontological publishing. Many serials unduly mix the categories, and many authors do not bother very much. Many authors still look at the publication procedure only as a conversion of manuscript into print, and the only active channelling they bother about is the circulation of offprints. Institutional parochialism, occasional publishing opportunities, compliant editing or refereeing and good offprint conditions often eliminate further considerations of strategy (Martinsson, 1976b).

After 1960 the number of serials within the earlier established national and international pattern has increased considerably. Among the journals, and not aiming at completeness, I would like to mention *Géobios* (1968), *Revista Española de Micropaleontología* (1969), *Alcheringa* (1975) and *Marine Micropaleontology* (1976). Three new facets were added at the international level in the form of *Palaeogeography*, *Palaeoclimatology*, *Palaeoecology* (1965).

NOMOTHEtical JOURNALS AND THE NEED FOR PROGRAMMES

Lethaia was launched in 1968 with the explicit ambition to single out the nomothetical element in palaeontology and stratigraphy and to present it technically in an integrated journal style, developed by experimentation with a couple of national serials, with the illustrations at their proper place in the text as in any commonplace magazine (Martinsson, 1968). The programme was defined widely enough to cover the interest range of the normal, internationally oriented palaeontologist, taking into account the stratigraphical involvement which most palaeontologists have, particularly in the palaeoecological flank. The nomothetical approach was favoured with the understanding that the presentation of theory must usually be intimately accompanied by fair idiographic support, which means that a certain type of «building-stone» packages were promoted at the cost of «routine» systematics and local descriptions. The strong tendency to concentrate the nomothetical interest in palaeontology on recent material (natural from the point of view that neontologists do not pay sufficient interest to fossilizable tissues and traces) soon led to stressing the necessity of devoting more of the special efforts to «the palaeontology of fossils». If *Lethaia*'s niche had been defined ten years later, it would probably have been somewhat different, and narrower.

A somewhat different niche was taken by *Paleobiology*, launched in 1975 to cater for common interests in palaeobiology and neobiology. Although in this journal, too, «taxonomic papers are welcome if they have significant and broad applications», «the emphasis should be upon biological or palaeobiological processes and patterns», and the journal rapidly established itself as a typically nomothetical journal with much emphasis on evolutionary theory and adjoining aspects. Othenio Abel's remarkable pioneering with the somewhat irregular serial *Palaeobiologica* (eight *Jahrgänge*

1928-1948), based on a closely similar programme, was recently reviewed by Reif (1980).

It is favourable for the channelling of information if serials take definite niches in the pattern of publishing as the two mentioned ones or, to take an example from the idiographical category, *Senckenbergiana Lethaea*. Nomothetical material has the inherent property of being of international interest, but it is easy to identify material of a faunistic, floristic and biostratigraphical character which has a more natural place in national publications and which would be more easily retrievable in them. However, there are few countries which have palaeontological communities large enough to maintain journals or even occasional series specialized in the field. Within a country palaeontologists often keep to different mixed geological or biological series for administrative reasons, depending on whether they do their research at a university, a museum or an institution of geological survey type. To some extent the disadvantages of publication in mixed national or institutional series is compensated for by the fact that at the national level the specialization pressure is weaker and that, e.g., geologists are interested in following what happens within their own country over the entire field of «geology». The serials which do try to specialize often tend to become dull, due to infrequent appearance, editorial weakness, unreliable local financing, etc.

Even for undifferentiated geology many countries are too small to maintain an economically healthy journal with a sufficiently professional editorial staff. Mergers of publishing interests in groups of countries would be a natural remedy to this, but as far as national geological societies are concerned, efforts in this direction have not been successful even in the most promising groups of countries. The neontologists are only very slightly ahead in this development. It is not only chauvinism which serves to maintain the old structure — literature exchange is a frequent reason.

Before leaving the journals for other types of serial and non-serial publications we can establish that there are probably several niches in the international publishing pattern which could be filled with journals proper with a satisfactory subscribership if the material from mixed serials and occasional collective volumes were brought together under a convenient programme. Most of these niches are in idiographical palaeontology and will be exemplified in the next section.

PALAEONTOGRAPHY

We have already established that idiographical palaeontology tends to result in large portions of documentation which sell slowly. Hence they are unattractive to publishers and need subsidies. However, those who make decisions about subsidies in scientific publishing are often laymen or dominated by representatives of the «hard sciences», such as physics and chemistry, who are used to nomothetical publishing for a large international subscribership. They cannot understand why the output of idiographical science sells less well than nomothetics and spontaneously take this as an indication of inferior quality. Neither do they see the point that if resources are not procured for the publication of results, idiographical or nomothetical, this means writing off tenfold or hundredfold investments in the research which led to the results. This of course refers to free academic research.

It follows from our previous discussion that idiographical palaeontology needs a category of open-ended serials which we called monograph-and-memoir series. Information scien-

tists in different countries, in practice the librarians, have had particular difficulties in finding a good and unambiguous term for this category of serials — in English they are often called occasional series and in German *Schriftenreihen in zwangsloser Folge*. The English term monographic series is somewhat ambiguous. The Swedish *monografiserie* was well established as a concept among the librarians as long as there was continuity in their education but suffered in wider usage from the semantic disadvantage that its component parts are very frequently not monographs with regard to their scientific contents.

Much paleontology is still published as journal articles, and since the nomothetical journals select only those which serve a core function in the continuing advancement of science, the «routine» and «regional» material still remains in the mixed geological and biological (plants and vertebrates) journals. The obvious exception is micropalaeontology with the international journals previously mentioned.

The obvious international niches and programmes which may be created for idiographical journals may be divided between «biological» and «geological» palaeontology. With strong steering and solidarity and with dedicated editors it would probably be possible to assemble the widely-dispersed palaeontology in such disciplines as trilobitology, ostracodology, conodontology, foraminiferology, etc., into regular journals with sufficiently numerous institutional and individual subscribers, interested enough in coverage down to the species level within their specialization in the biological system. The *Journal on Foraminiferal Research* seems to be the pioneer in this category. «Geological» palaeontology, including biostratigraphy, would profit in a similar way from journals specializing in, e.g., the systems of the stratigraphical column. One such journal has recently been launched, *Cretaceous Research* (1980), in addition to the traditional identification of the Quaternary as a system with special publishing requirements (Quaternary palaeontology, however, is more split between biological and geological media than the rest of palaeontology), and *Precambrian Research* (1973) may theoretically serve as a recipient for some of the palaeontology of the oldest fossils. It is necessary, however, that such journals are well-programmed as idiographic media as far as the palaeontological material is concerned and run with consistency — otherwise destructive cross-competition will disturb the optimal channelling patterns.

If geological societies now still take care of the palaeontographical journal articles, who is then responsible for the rest? Academies and societies run a number of monograph and memoir series under titles like *Palaeontologia Sinica*, *Palaeontologia Polonica* and *Palaeontologia Indica*. Very few are still with commercial publishers, as the old massive *Palaeontographica* or the new *Fossils and Strata* (from 1971). Combination with geology is often explicit in institutional series such as *Geologica et Palaeontologica* from Marburg which is one of the more recent creations in its category (from 1967; distributed as a yearbook with supplements) but follows and represents the still widespread pattern of mixing any small or large, nomothetical or idiographical, local or international contributions assembled within the connections of the paternal institution or at conferences under its auspices. A much missed monograph series was the *Paläontologische Abhandlungen*, discontinued in 1973 after six volumes and «merged» with the mixed-subject and mixed-aspect complex called *Zeitschrift für Geologische Wissenschaften*, a step in the direction opposite to the one recommended here, definitely towards less attractiveness to

the specialized subscriber. A curious hybrid between monographic contents and journal budgeting is found in the *Palaeontographical Society Monographs* where the packaging in occasional volumes is suspended in favour of a system intended to give the membership a certain number of sheets with a certain diversity within the annual budget.

This takes us to the desperate splitting of coherent monographic material which often takes place in order to accommodate the material within the maximum size of journal articles when monograph financing is found to be «impossible» or to require effort. This means bad publishing economy, both in a short-term perspective at the source and in a long-term perspective in the scientific community. If a monograph is unnecessarily split into five distributional parts, it means five times the costs for covers, envelopes, addressing, postage (more than five times since the postage rates are retrogressive), marketing and some of the overheads. Where the parts are received in a thousand public and private libraries the time and costs for receiving the paper are multiplied by five (the costs for cataloguing and shelving individual documents are very often higher than their market prices). These costs are covered from the general account of international Science. The parts will for all time have to be specified in synonymy and reference lists, in many catalogues and in retrieval systems. When it is possible to re-cast the monograph into journal articles, the cover and distribution costs may not be increased to the same degree, but instead the articles usually require duplication of introductory material and large parts of the reference lists in order to be readable. Splitting of optimal packages should by all means be avoided.

The ultimate responsibility for the rest of the «routine» or «national» palaeontology rests with the governmental institutions which are generally called Geological Surveys (Commissions, National Research Institutes, etc.). One of their natural tasks is the regional inventory of rocks, minerals and fossils in their respective countries and their documentation in museum collections and in publications. If the contributions have been made by scientists not on the staff of these institutions but meet their requirements for quality, they should be acceptable as gifts to the institutions of work which, again, represents ten or hundred times the printing costs (cf. Martinsson, 1972).

Concluding the main discussion on the nomothetical and idiographical results of palaeontology and placing the stamp of «routine», «local» and «national» on large and important parts of the idiographic output, I find it exceedingly important to stress that there should be no difference in status or quality requirements between the different categories. Taxonomic work at the species level or critical logging of fossils in a local section or core require the same level of skill as formulating palaeontological theory, perhaps by people with other temperaments, interest profiles, or even types of intelligence, for whom we should be anxious to provide equal opportunities, not only in publishing.

CONGRESS, CONFERENCE AND SYMPOSIUM PUBLICATIONS AND OCCASIONAL VOLUMES OF ARTICLES

Leaving the structuring and channelling problems of the serials, we are still left with some of the major problems in palaeontological publishing.

These concern the proceedings of meetings with different denominations and the non-serial collections of articles

issued as occasional volumes. They have one favourable structural property in common, namely that they usually provide material from one subject area within a substantial package. Some of the best organized «symposium» volumes with invited, pre-defined contributions have such a complete coverage that they form excellent handbooks or textbooks.

Otherwise proceedings of meetings accumulate all the deficiencies of scientific publishing. They practically always imply an exceedingly expensive duplication of presentation in identical oral and printed forms (Martinsson, 1974; 1976a). The contributions are mostly withdrawn from normal quality control by refereeing, or the refereeing is done at the wrong stage of organization (Mantén 1974b; 1976). The editing is often done by unqualified and unexperienced persons, with dramatic technical and economical consequences. The distribution is mostly deficient—in the extreme cases the proceedings are given to the participants as a token of their presence at the meeting and not very actively distributed beyond that. Many symposium volumes are not covered by the secondary services.

The distribution and coverage by the secondary services are slightly improved if the proceedings are placed in a serial. Then, however, other disadvantages are added. If the proceedings are placed in a special volume, *hors-de-série*, to be purchased extra, the distributional effect is minimal. If they are placed as a regular issue within the annual budget and price of a journal, the waiting-list for normal articles is prolonged by the period covered by that issue. In the several other arrangements which can be made, the financing or editorial structure of the serial are likely to become upset, or there will be responsibility conflicts between organizers and editors.

«Paper-reading» sessions should be avoided, and so should special symposium volumes. Meetings for oral presentation should be organized because of the advantages of that particular form of presentation, such as the opportunity of presenting material in free and updated forms or with projected illustration in unpublishable quantities and colours, discussion, etc. The published output of conferences should be channelled through the appropriate serials. This policy has been endorsed and actively promoted for many years by the International Union of Geological Sciences (IUGS, 1973).

Volumes of sundry primary articles within the most diverse fields, collected with or without the background of a meeting, constitute much of the output of palaeontology in the USSR. This literature is very difficult to handle and control because of the generalized titles, the repetitiveness in the contents and the small number of copies printed which makes them unavailable soon after publication. In the People's Republic of China such occasional publishing of primary results was adopted, with some extremes, but present trends seem to favour a serial structure.

PUBLICIZING IN PALAEOLOGY

Channelling of primary scientific results cannot be taken to the extreme that every specialist gets only what he wants. There are both economic and scientific reasons for an optimal dilution—in order to obtain a sufficiently large subscribership and to avoid isolation from neighbouring fields of research. A few large journals instead carry dilution to the extreme, surpassing even the mass media in the relation between used information and wasted paper. They survive as primary publications because of power established early in

the still encyclopedic times, the need of many institutions, newspapers, journalists and teachers to keep one prestigious scientific magazine, and perhaps primitive wishes to remain or become more interdisciplinary in the too specialized world of science. The palaeontologists who publish in *Science* and *Nature* (London) certainly do not do this with the primary aim of conveying their results to the user but, e.g., to get their findings out quickly to claim priority or to have a chance of getting them publicly highlighted before being buried in the masses of paper with unlimitedly mixed contents.

These attitudes are certainly of some value for the profession, although it is difficult for even the most sensational discoveries in palaeontology to penetrate the journalistic walls around society and around public knowledge unless they deal with dinosaurs, woolly mammoths, fossil man, silicified wood [sic!] or early life, in about that order.

Modern structured journals should compete more actively with the anachronistic mixed ones in providing quick services for discoveries (this is possible even for a quarterly) and efficient editorial news releases. Instead, what is needed in addition for the journalists and school-teachers and for the nimbus shelves of firms and institutions is good, interdisciplinary review journals.

The negative impact of the conservative editorial routines and technical expression (however modern their hardware may be) of these large-circulation journals on scientific publishing is not negligible. Contributors both to them and to small-circulation journals do not realize that the relations between, e.g., editorial overheads and space economy are inverted if the two types of journals are compared.

OFFPRINTS AND REPRINTS IN PALAEOLOGY

It might surprise some readers that an offprinted or reprinted journal article (a «separate») is not a publication but a circular. Publication, namely, means universal availability to known and unknown users in the present and the future, but separates are circulated to a limited group of users known to the author. The offprint is a circular even if it comes from the same press run as the sheets for a publication (cf. Martinsson, 1978a).

The unusually diversified structure of palaeontological publishing makes offprints more important in palaeontology than in most other sciences. Fortunately publishers are usually not disturbed by the authors' circulation of free offprints besides the commercial distribution of the journal. However, the production of offprints, and particularly reprints, may cause considerable disturbances and costs in the printing shop, if not streamlined properly. The traditional separate, with deletion of foreign text in the same sheet, addition of bibliographical data, and in covers with the article title, involve much labour of which the author possibly becomes aware when he finds that the extra covers of his extra offprints cost considerably more than the body of quite a normal article. Surprisingly numerous palaeontological editors do not seem to know how to arrange their articles and ordering routines in order to make the reprints inexpensive and avoid complications and delay.

The author's offprints are an excellent medium for channelling scientific information, for advertising the journal, for remunerating the author and for establishing collegiate relationships in science. Hence the offprints are worth much attention, and they still represent an

area in need of widespread technical rationalization.

Directories are the catalysts of offprint circulation, and newsletters are important for identifying new specialists to whom circulation should be extended (Martinsson, 1975a and 1977a).

Most publishers will agree that author's offprints (or reprints) have promotional rather than competition effects and that a well-planned offprint production is a reasonable service to science. However, they will react violently against any touch of piracy in reprinting or reprographic copying. Let us show solidarity with them.

PALAEONTOLOGY AND THE SECONDARY SERVICES

The scattering of palaeontology over a wide subject range and the division between the earth and life sciences characterize the appearance of the subject in the abstracting, indexing and awareness services, too. In large systems, such as *Biosis* and *GeoRef*, palaeontology is largely retrieved according to the primary authors' identification of themselves as «biologists» or «geologists» when they published their articles. Some systems do have palaeontology specified in their section titles, such as 227 *Paléontologie* of the *Bulletin signalétique* or 08B *Paleontologija, stratigrafija* of the *Referativnyj zhurnal*. A particularly readable paper-medium service is provided by the section *Paläontologie* in the *Zentralblatt für Geologie und Paläontologie* where the bibliographical references to journal articles will not necessarily be annotated separately but supplemented by a synthesis rather at the tertiary level of publications (there are also formal book reviews). The geological side of secondary services applicable to palaeontology was described extensively by Lea, Diment & Harvey (1973).

Exactly how far the biological and geological services succeed in overlapping by including palaeontology from each others' fields and to what extent both are covered by those services which have a special section for palaeontology is a fairly large study which remains to be made. In the leading current awareness service («alerting service») in the world, *Current Contents*, the subdivision on editions is such that palaeontology is practically homeless. *Geotitles Weekly* covers palaeontology published in geological serials and various other publications, including conference programmes.

When authors are asked to place their primary articles strategically and use the channelling effects of the structured publications, the reaction is often that they can be placed anywhere, because the secondary services will have them and find them in whatever mixed or local company they occur. This is a very serious misconception. For practical and economical reasons the secondary services must concentrate on a limited number of core serials, in our case generally specializing within the earth and life sciences. Very few mixed serials succeed to obtain systematic coverage in these systems, but some more specialized local or institutional ones, even if they belong to the grey literature, seem to do better in some of them.

PALAEONTOLOGICAL REVIEWS- MOSTLY IN BOOKS

Review articles are mostly referred to as the tertiary level of

publications, although this term is becoming increasingly ambiguous. At this level they are in the good company of textbooks and handbooks, and they all have in common that they often become so influenced by their creative authors that they are rather primary publications with particularly generous quotations.

This area has been the subject of some methodological study (Manten, 1973), and the International Union of Geological Sciences had for several years as special «board» for promoting the production of reviews, without much success.

Again, namely, the ambivalent position of palaeontology is highlighted by the fact that review articles have considerable identity in the life sciences but not much so in the earth sciences. Even very early extinct groups, such as the archaeocyathids and the graptolites, have been surveyed in the *Biological Reviews*. In the review journals (I take the traditional Swedish view that yearbooks are journals proper) the *Earth-Science Reviews* and the *Annual Review of Earth and Planetary Science* have not contained much palaeontological material, and there is hardly any affluence of any kind of review articles intended for geological journals.

One should not be too quick to draw the conclusion that works of this category are not produced in the earth sciences. It rather seems as if all that is produced in this category is solicited as chapters in textbooks and state-of-the-art volumes in book form, and this concerns both «geological» and «biological» palaeontology. The *Treatise on Invertebrate Paleontology* has certainly kept potential review writers busy for decades with syntheses of a related kind.

Also, primary journals willingly accept review articles for the simple reason already referred to, i.e. that they mostly are original, creative and similar to the primary articles in structure. An interesting reverse example is provided by the *Review of Palaeobotany and Palynology* which besides the reviews contains «various contributions» of a purely primary nature.

At this point we have probably covered all that is characteristic of palaeontological publishing in both serials and books. It remains only to say that at the textbook level palaeontology does have an identity of its own and a structure pretty like other sciences. When the textbooks become specialized, this is primarily into independent books in invertebrate palaeontology, vertebrate palaeontology and palaeobotany, not as appendices to neontology. When in the latter two branches neontology is also covered, it is even the fossils and the phylogeny of extinct forms which tend to prevail.

LANGUAGE, TERMINOLOGY AND NOMENCLATURE

In the ensuing sections I find it necessary to abstain from all efforts to provide a guide to manuscript writing and concentrate on some features of general importance in palaeontology.

Language structure has been studied within palaeontology or in closely related earth and life sciences (e.g., Manten, 1974a with further references; Bengtson, 1980; Weimarck, 1980). English is shown to have taken over the role as the leading scientific language, not only as a consequence of the politicians' wars. It has attracted the majority of scientific authors in most scientifically developed countries. For the first time, after a century of struggle and indecision, we can

discern the successor of Latin in this sphere, still with much Latin in the vocabulary, with a rudimentary Germanic grammar and with puzzling but not too irregular pronunciation. Russian maintains a strong position in the very comprehensive international output from the USSR. A few countries, some of them in groups, maintain language isolation even if it leads to their not so large international output being hidden or swamped in text which is not widely understood and covered by the leading abstracting and indexing services.

A language does not become an international scientific language because it is the mother-tongue of many people or because it has superior phonetical and constructional qualities (if so, I would choose Finnish, a «small» language which is very far from my own). It must be understood as widely as possible by scientists in *other* language areas. For example, the enormous population and important scientific activities in China do not make Chinese an international scientific language as long as a fair majority of those who are creative in international science elsewhere do not understand Chinese. We must be pragmatic about the international scientific language, neither fanatic when trying to make it only one, nor chauvinistic when judging the possibilities of our mother-tongue. Experience shows that we all manage with one or a few languages in addition to our mother-tongue, usually not more. Let us adjust our attitudes and preferably our school systems to this fact.

For accuracy and conciseness palaeontology is assisted by two major systems of terminology and nomenclature, one for biology and one for stratigraphy, with many accessory elements from various earth sciences. Biosystematic and stratigraphical nomenclatures are regulated by international Codes and a Guide, respectively. Since we are concentrating on concepts and methods, I restrict citations to a unique zoological classic which should guide our approach to biosystematic nomenclature, written by a palaeontologist, namely Rudolf Richter's *Einführung* of 1948 to the International Code on Zoological Nomenclature. We must avoid making him the last who really bothered.

Among all the details omitted here there is one methodological aspect which should receive particular attention. The truly international element in all terminology and nomenclature is based on Latin, or Greek in a slightly latinized form. Both terminology and nomenclature in biology and stratigraphy have in common that they retain a natural linguistic base, without many artificial elements. In this respect they contrast sharply with, e.g., chemistry and technology, where the terms are formed from arbitrarily truncated stems and other fragments of the classical and other languages, with highly artificial affixes and sometimes with artificial rules to replace the suspended natural ones. The limit of order is somewhere between pharmacology and pharmaceuticals — there the chaos of business language comes in.

Why is it meaningful to retain order, when market brands show that such constructions can be memorized? There are a number of reasons. By knowing some terms in an orderly system we are guided in the construction of other terms down to the details of spelling, and we may profit considerably from the semantics inherent in the system. Terms of market-brand type, however, are coined and inculcated, not understood.

The first common misconception in this complex is that one must know all Latin and Greek «grammar» in order to construct correct terms and names in palaeontology. On the contrary, only limited parts of the accidence are required, and familiarity with only a few rules will eliminate so many mistakes that stability is obtained. This is a good reason for

palaeontological editors to insist upon order in terminology.

Biosystematical nomenclature appears in a form close to grammatical Latin, including latinized Greek and roots from elsewhere. Since the Middle Ages, however, many and widely different languages have adopted harmonious rules for assimilating classical terminology into commonplace language. Some of the main systematic names are also vernacularized in this way, such as trilobites, ostracodes, conodonts, graptolites and foraminifers.

English is particularly amenable to such harmonious vernacularization, and its position as an international language, not least in science, is largely due to this property. This is where the second major misconception comes into the picture: in a less scholarly-minded age even English-speaking scientists believe that English word construction and spelling are all chaos, and that rules not recognizable to them should give way to the accidental coining of vernacular terms. This is why some claim that ostracode should be treated differently from nematode and cestode and foraminifer differently from rotifer and conifer. Somebody just unknowingly coined it otherwise and started a school. On the local level and for the specialist it is as easy to keep track of these aberrations as any market brands, but the practitioners of international, scientific English are exposed to wrestling with an unlimited number of cases instead of a few rules. This is another good reason for palaeontological editors to insist upon order.

The editors of *Lethaia* have done this in a handful of cases (only a few remain to be discussed), and again this is sufficient to remove all the most disturbing irregularities (see, e.g., Martinsson, 1970, 1975b, 1975c, 1979a, 1979b).

Most palaeontologists have to construct systematic names and even terms, and it is a reassuring fact that it is easier for a non-English scientist to construct an excellent vernacular term in English than to write an acceptable commonplace text in the same language. Creating a new name or term is still science and nothing to be done off-handedly. This is an important methodological field to be controlled by palaeontological editors.

NEW APPROACHES, TECHNIQUES AND STANDARDS

The development of scientific publishing is described as «explosive» and «exponential», but there is no evidence that an increasing proportion of the funding of research is allotted to it — perhaps rather the contrary. Although publishing is a minor account in the economy of science, it is a favourite target area for financial cuts, and in the natural sciences idiographical publishing, so important in palaeontology, suffers most.

It is obvious that there are several methods of making palaeontology more concise. The techniques of photographic illustrations have improved immensely, and it has become proportionally less expensive to publish all kinds of illustrations as compared with the text. Features in addition to the truly diagnostic ones do not have to be described verbally. The ideal, concise species description would be one where the diagnosis and all type data are assembled in an extended caption to a composite illustration, with different views and details of the specimens and with the making-up of the pages buffered with the largely nomothetical core text on the relationships, evolution, distribution, etc., of the group treated. The full description, or features which subsequently turn out to be more important than realized at the time of

original description, are easy to find by study of the illustrations.

Related principles are embodied in Sylvester-Bradley's (1973) «new palaeontography» as displayed in the *Stereo-Atlas of Ostracod[er] Shells* where, within a distributional structure which is probably correctly to be referred to as a journal proper, the ultimate handling and retrieval form for the species described is a file of stereoscopic cards, to be successively built up by the user in alphabetical or systematic order.

An area in obvious need of methodological re-thinking is the space-consuming synonymy list. Although most palaeontological journals have adopted the name-and-year system of citations, with a corresponding reference list at the end of the paper, many authors and editors have not yet taken the consequence of this fact when constructing synonymy lists. Also, since synonymy lists are consulted only in very specific situations of critical taxonomical study, and not read right through as the rest of the text, it is questionable whether it is justified to maintain them with a new line for each new citation, in many cases leaving more empty space than text.

Another form of space-saving is represented by the *synopsis publication* introduced in a rigid form in chemistry (e.g., Grünewald, 1971; Williams, 1979). Individual subscribers are provided with a journal of synopses only, standardized within one page or two facing pages containing title and identification data, an abstract and some further core information in the form of text and graphs. The libraries of research institutions, etc., may then subscribe to an incomparably more expensive «back-up» journal with the full texts of the articles.

Such a system may function in a large, «hard» nomothetical sciences like chemistry but hardly in palaeontology. It is obvious, however, that idiographic palaeontology in particular could profit from a more flexible type of *synoptic publishing* (Martinsson, 1977b) where very concentrated presentations of varying length in serials are supplemented by back-up material in special depositories, consisting of very generous texts, collections of numerical data and illustrations in sizes and colours which in many cases would not have been published under any conditions. The deposited material is made available by loans or «publication on demand». However, fear that publishing of this type would be less prestigious is certainly a reason for resistance, and it is difficult to find convenient, adequately staffed depositories. An offer from *Lethaia* to open its pages for synoptic publishing of this type resulted in one submission only, which moreover turned out to be unsuitable under the programme of the journal.

Fifty years ago publication of palaeontological text could in practice take place only by letterpress printing, and even twenty or fifteen years ago few palaeontologists would consider anything but this method or the fully professional offset printing which by then was taking over at the industrial level. Research departments were hardly tempted to apply mimeography or reprography to real publishing. New techniques, more or less correctly referred to as «offset», have opened the possibilities of non-professional publication at costs concealed in the administrative budget of departments, where typesetting is replaced by camera-ready typescript. The resulting «grey literature» has become a problem, owing to obvious dissemination deficiencies and lack of coverage by the secondary services. In palaeontology the problem is still of very limited importance, probably owing to reluctance to accept illustrations of non-professional quality. However,

sometimes it is uncertain whether a document with descriptive palaeontology is a publication or not.

Neither have the non-paper media, microfiche and electronic recordings, gained ground in palaeontology, obviously again owing to requirements on quality and easy handling of the illustrations. In systematic palaeontology there are even obstacles of a legal nature insofar as the nomenclature codes, in clauses which are not up to date with the technical development, explicitly or implicitly do not recognize other publications than those «printed» on a paper medium. In theory, and even within the limits of existing technology, photographs on microfiche may attain better quality than any screened halftones on paper, and the systematist's wish to compare illustrations and even texts finds ideal solutions in the electronic media. However, this is not what practical reality looks like.

The present situation is that palaeontologists avoid those few journals in the earth and life sciences which have changed from paper to exclusively microfiche. Among the journals specializing in palaeontology, *Alcheringa* was first to publish certain materials on microfiche (Runnegar, 1977). Corresponding tests with *Lethaia* did not encourage abandonment of the paper medium and did not reach the public — when at last in 1980 hard-copy subscribers were offered supplementary air-speeded copies at a much reduced price, interest was inconsiderable. As far as the electronic journal is concerned, we do not even know whether it will contain continually updated information packages, series of updated full editions of articles or successive articles as in the present system. Continuous updating is a very immediate possibility in electronic media, but it is in conflict with all our present norms for documenting ideas and results in an historical context, and nothing could be more incompatible with the present basis and procedures of taxonomy.

Technical development is accompanied by standardization for better economy, compatibility of systems and continued refinement. Publishing is no exception, but standards are usually created by elevating compromises between local house-rules to the rank of internationally agreed documents instead of being based on methodological considerations (Martinsson, 1979c). Again in order to avoid converting this article into a bibliographical guide to dozens of applicable standards, I would like to mention one which is indeed intended to serve the scientists' daily handling of literature as displayed here, one of the few standards in publishing worked out with some methodological ambition. This is the present ISO DIS 30 on the bibliographical identification (biblid) of serial publications:

Everybody is familiar with the frequent lack of essential data on reprints and reprographic copies of articles to be included in the network of references, and with the relatively time-consuming work of extracting such references from the title-pages when they are available with the article. The biblid standard (Martinsson, 1978b) represents an attempt at bringing those identification data which are found in various places on scientific documents into such a system that offprinting or copying do not eliminate an authoritative reference in the source (for articles), or at least as much information as is necessary for tracing the source (for pages). How difficult it is to get the references correct and how deficient even the leading journals are in this respect is illustrated in a study by Poyer (1979).

A complete guide to standards and selected standard-like documents in scientific publishing was published recently (chapters 1-5 in UNISIST-BDI, 1980). The state of the art in

standardization in areas of particular concern to us has recently been summarized by Rigg (1981). Again, as we found for the methodology of palaeontological publishing, the number of specialists involved in the development is very small. It is essential to remember, however, that standardization achieved informally by dint of good editorial example is perhaps more important than formally agreed international standards (Rigg, 1978; Martinsson, 1979c; Huth, 1979). Standardizers prefer piecemeal specification to construction of systems. Such a system which I would like to recommend for adoption with priority for palaeontological publishing in all language areas is the article-head representing an interplay between title, bibliid-provided abstract and keywords (Martinsson, 1978c) which is already wide-spread in the earth and life sciences.

CONCLUSIONS

Primary publishing in palaeontology is extremely diversified and draws very heavily on the serials of the parental sciences —geology, botany and zoology— and on entirely mixed serials. Parts of this pattern have to be retained, but we have to use it with much more strategic planning than hitherto in order to channel the right information to the right user in the most convenient package.

In the first place we should make optimal use of the serials specializing in palaeontology or in its different branches according to different international or national publishing programmes or profiles. This concerns in particular nomothetical palaeontology. Unity and good organization among specialists may lead to the establishment of viable journals in more niches of publishing, particularly in idiographical palaeontology.

Secondly, the journals proper in geology, botany and zoology will in the foreseeable future retain a strong position in palaeontological publishing. This concerns particularly minor contributions of an idiographical character to national journals, but much more consistent channelling than now is desirable.

Thirdly, the publication of the comprehensive inventory of the fossil floras and faunas and of the fossiliferous rocks in different countries is a primary responsibility of geological surveys and comparable national institutions. Palaeontologists not belonging to geological survey staffs should in all countries insist upon acceptance of their major contributions of this category in the memoir and monograph series of the geological surveys in order to obtain a rational publishing structure.

Fourthly, contributions to scientific meetings in palaeontology should be channelled individually through the most appropriate serials, be subject to their quality control and should take advantage of their established distribution. The scientific proceedings of a meeting should be assembled in a special volume only where they are organized to cover a subject field with the completeness of a textbook or handbook.

Publication of primary research articles in mixed, all-science serials should be discouraged entirely, and this particularly concerns all documents of such a small size that they cannot be announced and publicized individually within the publishers' marketing efforts. The interdisciplinary approach to science is not served by undue mixing of primary results, and the interests of rapid publicity or priority claims by no means balance the mischannelling and burial of results.

It is realistic to regard offprint circulation as a valuable complement to publishing in palaeontology, and it should be developed as such, both with regard to clear philosophy of their role and rational forms for their production, which is now often antiquated and labour-consuming. Directories and specialists' newsletters are important catalysts of offprint circulation.

The language structure of palaeontological publishing still leaves much to be desired with regard to strategical planning for reaching the readership. Even for local papers the provision of abstracts (with non-bibliographical title translations and keywords) in at least one «international» language used by the abstracting and indexing services is recommendable. In palaeontology the role of English as the preferred and most efficient international language is obvious.

Further development of paper-medium journals in palaeontology is strongly motivated, in spite of recent advances with film-bases and electronics. Particularly idiographical palaeontology can easily be developed towards better economy and communicational efficiency, both structurally and technically.

Palaeontology will in our time remain a subject torn between publication media with different functions. Hence logics and constancy in our strategy of placing articles will always be of considerable help for direct retrieval. Secondary services help us only partially and more slowly in our current work (but are very good to have when we start on a new research topic), and we have to use both the geological and the biological ones.

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