Cour. Forsch.-Inst. Senckenberg, **83**: 1-14. — Frankfurt a. M., 16. 6. 1986

Guidelines and Statutes of the International Commission on Stratigraphy (ICS)

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ISSN 0341-4116
ISBN 3-924500-19-3

This is a publication of the Commission on Stratigraphy of the International Union of Geological Sciences

Courier Forschungsinstitut Senckenberg

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Herstellung und Vertrieb:
Senckenbergische Naturforschende Gesellschaft, Senckenberganlage 25, D-6000 Frankfurt am Main

Umschlaggestaltung:
Renate Klein-Rödder

Druck:
Offset- + Buchdruck GmbH Druckerei Kempkes, Gladenbach

Guidelines and Statutes of the International Commission on Stratigraphy (ICS)

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March 1986

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Preamble

In recent years the increasing volume and complexity of the work of the International Commission on Stratigraphy (ICS), a commission of the International Union of Geological Sciences (IUGS), has created a demand for procedural guidelines and for updating and reissue of the Statutes of ICS.

The following Guidelines have been shown to the President and Secretary-General of IUGS but the Bureau of ICS are solely responsible for their content.

The Statutes, however, constitute a formal directive document which has been ratified by the Executive Committee of IUGS in February 1986.

The Commission is responsible for the coordination of international stratigraphy from the earliest part of the Archaen Eon through the Proterozoic and Phanerozoic Eons to the Recent and includes studies on all aspects of stratigraphy — physical, chemical and biological. A considerable part of these guidelines is devoted to the currently important topic for ICS of selection and definition of Boundary Stratotypes. It must not be assumed, however, that other aspects of stratigraphy are not of great importance too and developing studies in future years may considerably change the present emphasis and require further guidelines to be drawn up.

These guidelines are not necessarily retrospective and do not automatically affect decisions already approved and made by ICS and ratified by IUGS. The International Stratigraphic Guide (HEDBERG, 1976), prepared and published by the Subcommission on Stratigraphic Classification of ICS, contains valuable discussion and recommendations but it was never adopted by ICS as a statutory policy document; it is now being revised. These Guidelines and Statutes prepared by the Bureau of ICS should be used in preference when and where there is a difference between them and the International Stratigraphic Guide.

A. General

A. I. Introduction

1. Included in the statutory objectives of the International Commission on Stratigraphy (ICS) under IUGS are development of a standard global stratigraphic scale, distribution of information on its major subdivisions, establishment of their boundaries and correlation of their subdivisions. To achieve these objectives on an agreed international scale ICS has been established as the motivating, guiding and approving organization, subject to the oversight, monitoring and ratifying function of the IUGS Executive Committee and drawing upon ICSs constituent Subcommissions, Working Groups and Committees. These constituent bodies of ICS continue to elaborate and correlate standard global Series, Stages and Systems and a major part of this work has been to define boundaries between them. "Accurate communication without definition is impossible"(McLaren 1977: 23). Boundary Definition utilising a unique point in a rock sequence represents (if correctly selected in accordance with the practice given in these guidelines) as nothing else in material geology can, a unique instant of time thus defining, unequivocally, a standard against which other sequences can be correlated by the analysis of all available data. Unit and composite stratotypes do not fulfil these requirements.

2. Biological/Palaeontological species are subjective and the full range is unknown — due to incomplete research, or incompleteness of the geological record. This can be overcome by using several independent groups of fossils to correlate faunal/floral assemblages.

3. It is salutary to recall that "matters of positive science that concern nature, require discovery and apply some test of truth" should be distinguished from "matters of normative science, that are regulated by man as part of his method of understanding nature and which apply tests of correctness and utility." (Harland 1973: 571).

4. It can be argued that choices in international stratigraphy should violate historical priority as little as possible: this consideration can often be overridden by the higher priority of going for the best and making progress. Confusing historical precedents may need to be set aside by an authoritative international decision (which is very likely to violate some established usage) by a recognized authority like ICS.

5. Some ICS bodies may find it useful to have ex officio, voting, organizational, titular, honorary, associate and corresponding categories of membership. For the work within subcommissions, working groups and committees this is entirely acceptable to the Bureau of ICS. For the formal business of ICS (the Commission as a whole) it is necessary to identify all categories of members of ICS and its bodies as either Voting or Corresponding (Non-Voting) Members and these two categories must be clearly distinguishable and so reported in the annual return of membership.

6. It was decided at the 27th IGC in 1984 that decisions of ICS or of ICS bodies can best be achieved by postal ballot of all Voting Members of ICS or of ICS bodies, as the case may be.
This does not diminish the importance of face-to-face plenary meetings, of course, but enables them to make recommendations (to go later to a postal ballot) even when attendance at the meeting is restricted. A quorum for ICS or ICS bodies' Voting Members is fixed at the comparatively low figure of 35%. Under present financial restraint this quorum requirement can thus allow valid recommendations from meetings to be put to a postal ballot.

7. ICS is expecting that more proposals will be forthcoming in the next four/five years. Intersystem Boundary Working Groups (independently responsible to ICS and with their own financial allocation) and Intrasystem Boundary Working Groups of a Subcommission should normally conclude their work within a time not exceeding eight/nine years from their initiation.

A. II. Voting and other procedures

These can be generalised to include all approvals of decisions of both ICS and its constituent bodies.

1. ICS having been persuaded of the need of a special study a Committee, Working Group or Subcommission will be set up and by consultation a convening Chairman will be asked by the ICS Bureau to convene it. When the founding Voting Members have been recruited then officers are elected by them and submitted to the ICS Bureau for approval together with the list of Voting Members. Corresponding Members can later be recruited by the Working Group officers without recourse to ICS for approval. The membership should have a wide geographic spread and include experts with specialities in various disciplines but also a comparable proportion of those particularly interested in the stratigraphic subdivision above and below in the case of a boundary stratotype.

2. Study and review in field, laboratory and in the literature, with consultation of all with contributions to make can then proceed.

3. Discussion at a plenary session of an ICS body (or a series of plenary sessions) should lead to a selection of a candidate (or candidates but not more than two or three) to be put to a postal ballot of all the Voting Members. The time and place of a plenary session must be advertised,at least a year in advance, through circulars and geological magazines and journals. The place of meeting should be where all members have convenient access (with visas provided for all where appropriate). Any voting results of those present at the plenary session can be circulated for information (in an impartial fashion) but such votes have no mandatory status: the substantive measure is the postal ballot. If all members at the plenary session are allowed to vote it should be made clear in circulated information the proportions of Voting Members, Corresponding Members and guests and the voting numbers separately itemised. The quorate or non-quorate proportion of Voting Members must be given.

It is rarely, if ever, that all Voting Members can attend a plenary session because of competing commitments, some of which may be unavoidable, often because of paid employment duties.

4. Ideally the postal ballot should be for only one candidate at a time. If there are two or three candidates then these should be reduced to one by a preliminary postal ballot with an absolute majority of 50 % + 1 for it. The final postal ballot must be YES or NO for one candidate decision. The Chairman and Secretary-General of ICS or of the ICS body should conduct the postal ballot, supplying full and adequate documentation (including reports on plenary sessions) to each Voting Member. If there are more than one candidate, then the voting on each should be kept quite separate and not interdependent or grouped under one vote. Assistance in the work from Secretary or Vice-Chairman would not remove responsibility from the Chairman.

Formal Vote 63.6

5. In order to proceed to a Submission to ICS the vote should achieve a 60 % majority of the total vote of Voting Members. A clear consensus is desirable. A difficulty, of course, is the perennial one of 'non-voters', 'too-late-voters' and 'abstainers' — should they be excluded from the total from which the 60 % majority is demanded? One device is to stipulate on the voting paper that if a vote of YES or NO (abhorring 'Do not knows') is not received by a given deadline date from a Voting Member then that persons vote will be recorded as a YES on the grounds that if a Voting Member really wants to disagree then he will take the trouble to say NO in time. It is the responsibility of the Bureau of ICS to ensure that each Voting Member has actually received the Voting Papers. Genuine declared abstentions can be excluded from the calculation of the 60 % majority.

6. Intersystem and Intrasystem Boundary Working Groups will include members with interests on either side of the boundary and this representation will normally ensure that the flanking Subcommissions (X system and Y system, for example) will have full confidence in democratic decisions made by the Boundary Working Groups. The Bureau of ICS through the Chairman and Secretary General will ensure that this is so before proceeding to the next stage (7 below). In exceptional circumstances votes of the Subcommissions (X & Y) may be taken by postal ballots under the supervision of ICS. The motive at this stage is to monitor procedure and fulfilment of guidelines to ensure a fair decision and not to challenge geological scientific points.

7. The officers of the ICS body should then, having received the mandate of a 60 % majority vote, prepare a Submission to be sent to the ICS Chairman and by him to the Bureau. At this stage the submission will be checked against ICS guidelines and, if necessary, returned for amplification and amendment. THE SUBMISSIONS CAN BE SENT TO ICS AT ANY TIME. After processing and possible return to the Working Group for amplification a postal ballot of all Voting Members of ICS will require a majority in favour of 50 % + 1 votes for approval of the Submission. If it is wished for the ratification by IUGS Executive to be completed before a change of Chairman at the next International Geological Congress (or during the IGC) then a Submission deadline date of 8 months before the IGC must be fulfilled (e. g. 1 December 1988 for the 28th IGC in August 1989).

8. This Submission approved by ICS will then be sent by the ICS Chairman/Secretary General to the Executive Committee of IUGS for final approval and will be formally promulgated when approved. (In 1985 this has been done in the official IUGS Journal Episodes). It is expected that a full final report will be published in a widely circulated international geological journal.

9. Permanent artificial marking and recording in print and by visual aids (photographs, remote sensing, video recording, etc) of the Global Boundary Stratotype Section and Point (GSSP) in the field follows. Establishment of arrangements for preservation of the GSSP and accessibility for responsible and authorized study (having regard to conservation) should then be completed.

A. III. Notes on the role of ICS officers (Bureau) and the officers and members of Subcommissions, Working Groups and Committees generally

These are in amplification of the ICS Statutes.

1. The Chairman of ICS

(i) The Chairman (or a deputy from the Bureau of ICS) may attend all meetings of the Commission and its Subcommissions, Working Groups and Regional and other Committees.

(ii) The Chairman (or deputy) may ask to address the meeting in order to present any matters which ICS wishes to bring to the attention of the meeting.

2. Members of Subcommissions, Working Groups and Committees

Members are individual scientists with expertise and experience in their field and are not delegates of their nation, organisations, associations or any other bodies. They cannot, of course and rightly, shed their origins and loyalties but should vote as individuals. Membership should have a wide global geographic spread except in more limited Regional Committees.

As McLAREN so clearly argued (1977:24) "The principle to be learned here is that in this kind of a committee [Silurian-Devonian Boundary Committee] there must be no delegates who represent a particular point of view from a "school", society or nation. It is only by interacting among themselves, with freedom to change their minds that there can be any possibility of reaching an agreement".

As was stated in 1977 (VAN DER HEIDE: 3-4) after outlining the chief aims and objectives of IUGS: "It is important to stress that the above mentioned aims and objectives relate to the cooperation of geologists in their personal scientific capacity." In a later IUGS pamphlet (LAFFERTY 1981:2) it is again stated that IUGS is "A voluntary professional organization. It is non-governmental, non-political and non-profit-making." MARTINSSON (1976: 459-462) addressed these aspects relating to IUGS and IGCP advocating influence for a wide spectrum of geologists.

Voting Members shall be retired after a number of years of service (at the time of an IGC) so that ⅓ of the voting members become Corresponding Members at the time of each IGC. New Voting Members can then take their place.

Voting Members are subject to approval in their appointment by the Bureau of ICS; they are expected to have a number of years of professional experience and wisdom with wide geographic spread of coverage.

Corresponding Members do not need to be approved by the Bureau of ICS — they should be active workers in the field of interest of the body and keep in touch by correspondence and/or personal contact.

There is no limit to the number of Voting or Corresponding Members except practicality in communication and availability of finance. Personal contact and attendance at meetings would normally be expected of Voting Members.

Exceptions may be made in retirement rules given in both the ICS Guidelines and the Statutes if there is a real shortage of candidates with sufficient expertise and experience to replace officers and members of ICS bodies (or even the ICS Bureau).

The Bureau of ICS would expect to be consulted before this abnormal procedure was followed. Approval could then possibly be given by ICS and IUGS after consultation.

A. IV. Past, Present and Future of ICS

Beginning with the first International Geological Congress in Paris in 1878, most International Geological Congresses have had commissions and committees, with various names and with various durations, which have been concerned with international cooperation in stratigraphy, stratigraphic classification, and stratigraphic terminology.

At the 11th Congress, Stockholm, 1910, a Commission on a Lexicon of Stratigraphy was created. This Commission functioned modestly through many subsequent Congresses. At the 19th Congress, Algiers, 1952, however, its name was changed to Commission on Stratigraphy and it was made to include two Subcommissions, namely, a Subcommission on the Lexicon of Stratigraphy and a Subcommission on Stratigraphic Nomenclature. Since this time the Commission on Stratigraphy has functioned continuously and many new Subcommissions have been added.

In May, 1965, the Commission formally applied for admission to the IUGS and was accepted as a commission of the IUGS. At that time the membership of the Commission was drastically reduced from 150-200 members to consist only of its officers and the presidents of its Subcommissions.

The Commission currently operates in a general framework provided by Article VII, Sections 24-28, of the IUGS Statutes and supplementary sections of the By-laws and Regulations of IUGS . Having lacked any statutes of its own, many of the governing rules of the Commission and its subordinate bodies have grown up quite informally. The presently proposed Statutes have been formulated both to accord with the Statutes, By-laws and Regulations of IUGS, and to meet a need for specific rules while at the same time preserving, as far as they have proved satisfactory, the existing informal organizational outlines and operating procedures.

At the request of the organizers of the 28th International Geological Congress to be held in Washington, D. C., U.S.A. in August 1989 the Bureau of ICS is itself initiating and also soliciting from ICS Bodies details of planned meetings, seminars and symposia for the IGC.

The Commission on Stratigraphy's meetings (as distinct from ICS bodies) will be devoted to original scientific contributions and reviews on stratigraphy. These will be comparable with those given at the IUGS's "Stratigraphy: Quo Vadis" symposium held at Bad Honnef, Federal Republic of Germany in 1982. Only a limited time will be allocated to a short ICS business meeting.

Submissions from ICS bodies of proposals for ICS approval and subsequent ratification by IUGS can be dealt with AT ANY TIME using correspondence and postal ballot.

Through ICS scientific meetings the advancing fronts of stratigraphy can be presented at the 28th IGC.

B. Boundary Stratotypes

B. I. Introduction

1. Historical geology depends on positional relationships of rock and mineral bodies and identification of earth's evolutionary trends. "The importance of the boundary stratotype lies in its role as a future anchor to which all subsequent correlations can be tied, even if new palaeobiological or physical methods become available" and the importance of the boundary stratotype is because it is "the only place where we actually know (by definition) that time and rock coincide within our classification" (HOLLAND, 1984: 149).

2. Global Boundary stratotype sections and points (GSSP) allow maximum flexibility with the use of multiple hypotheses to give minimum ambiguity and the greatest likelihood of stability. It is essentially a unique and specific point in a specific sequence of rock strata in a unique and specific geographical location. This Boundary Stratotype Section and Point is the designated type of a stratigraphic boundary identified in published form and marked in the section as a specific point in a specific sequence of rock strata and constituting the standard for the definition and recognition of the stratigraphic boundary between two named global standard stratigraphic (chronostratigraphic) units.

The prefix Global is used to emphasise that the GSSP is a unique time signal for the world geological stratigraphic time scale.

Insistence on a Boundary Stratotype Point is in order to define without doubt an instant of geological time. A horizon will, at the GSSP locality, contain the Point but the horizon may, traced laterally, be diachronous (cutting across time-planes) and may drift away from the instant of time defined by the point thus vitiating the unique concept. The correctly selected GSSP gives an actual point in rock and is not an abstract concept — all other methods can prove to be diachronic. It will be excpected to remain fixed in spite of discoveries stratigraphically above and/or below. The main criterion must be that any horizon and point selected must be capable of being correlated over wide areas by any or all available methods. In a world which is not ideal it is most unlikely that all selected stratotype points can meet all the ideal requirements and stratigraphy must be a practical subject and responsive to the needs of working geologists.

The type locality of a GSSP is the specific unique geographic locality in which the stratotype is situated. A submission to ICS of a GSSP cannot be ratified on the basis of a recommended stratigraphic level only: the geographic locality must be exactly and precisely given.

The use of the prefixes holo-, para-, neo-, lecto-, hypo- to stratotype does little or nothing to assist in the definition of a GSSP for the purposes of international acceptance by ICS. Bodies of ICS may, for their own purposes wish to use the terminology but for the present at least ICS will not ratify it.

It is considered preferable not to use parabiological analogies which imply unsound analogies and cause confusion (e. g. holostratotype or parastratotype) but to confine nomenclature, for ICS candidates, to two categories of stratotype:
(a) global stratotype section and point (GSSP) and (b) auxiliary stratotype point (ASP) — the latter will be particularly useful in drawing upon stratigraphic correlation between markedly different facies, e. g. New Red Sandstone contrasted with marine Triassic or Devonian neritic facies contrasted with pelagic facies.

Supplementary sections furnishing additional elements of correlation will in any case be helpful and should be published but designations like "para-" or "hypostratotype" should be avoided as diluting and clouding the value of the GSSP. "It is not reasonable to expect the Commission on Stratigraphy presently to handle the matter of parastratotypes in a formal way. There is too much other urgent primary work on hand" (HOLLAND 1984:151).

The GSSP is unique and should not be subject to competition from these 'failed candidates' or 'syntypes' after a GSSP has been decided upon by ICS and IUGS. Otherwise international acceptance, prestige and respect for GSSPs will be delayed and may be diluted.

ICS still has a great volume of work to get through in the rest of this century and beyond and it will expedite matters if a plethora of lower status candidates are not submitted until the main GSSPs down to stage level are decided. Similarly regional stratotypes are the business of the region concerned and not relevant directly to the choice of a GSSP and the submission to ICS of a GSSP.

3. A Boundary Stratotype Point can be changed if a strong demand arises from further important research but will in the meantime give a stable point in time from an actual point in rock. For a change to be considered by ICS it would require support from 60 % of the Voting Members of the ICS body responsible for the Boundary and a 50 % + 1 majority of the Voting Members of ICS itself.

Boundary Stratotype Definition is a normative question which can be settled by a vote ..... an operational boundary capable of being extended as a line on a map (GLAESSNER 1984: 139).

B. II. Summary Requirements for a Submission to ICS of a candidate for a Global Stratotype Section and Point (GSSP)

A summary of the requirements are:

1. An explicit motivation for the choice of the boundary level, especially with respect to its correlation potential.

2. A correlation table showing the position of the proposed boundary with respect to former usage and to the most important markers, also clarifying rank and relative position of the unit under question.

3. An explicit motivation for the choice of the stratotype locality taking into account paleogeography, facies, tectonic "environment" and other relevant factors including facility of access.

4. Exact data about the location of the type section and point: coordinates on a detailed topographic map of large scale, explanatory maps, diagrams and photographs (including aerial) and remote sensing.

5. A detailed description of the type section and point with vertical section to a large scale with graphic and written details of all relevant stratigraphic data: lithology, rangechart of index fossils, magnetostratigraphy and geochronometry are very desirable.

6. Relationship of stratotype section and point sequence to globally significant marker horizons in the immediate and accessible region, e.g. faunal or floral zone assemblages stratigraphically above or below the stratotype point, climatic markers such as tillites and many other factors assisting long-range or preferable global correlation. Correlation must precede, and accompany, definition of a boundary. The choice of an appropriate boundary level for the point is only possible in the presence of a marker horizon which has proved to be isochronous within the limits of precision attainable by stratigraphic methods. Auxiliary marker horizons as close as possible to the boundary level will give good approximate stratigraphic positioning where and when the primary marker is missing.

B. III. Detailed guidelines for requirements and discussion:

1. Lithological succession, thickness, mineralogy, structure, geomorphic expression and other features. Vertical and horizontal sections, structure sections, graphic presentation of relevant factors e.g. isopachs. Seismic stratigraphy should be utilised. Photographs are particularly helpful.

2. The details of the global boundary section and point and its relationship to adjacent units. Markers (isochronous within limit of precision, palaeobiological, geochronometric, magnetostratigraphic, catastrophic, sedimentological, climatological etc.) near the GSSP and also correlatable with the GSSP succession in the region are of prime importance.

3. Clear and succinct reasons for the choice of the GSSP in both stratigraphic level and geographic location.

4. Methods used (or to be used if ratified) for the actual marking of the GSSP and particularly the actual stratotype point - "the golden spike". This should be a permanent artificial marker but described in position in words and visually by drawings and photographs so that removal by vandals or others does not prevent accurate restoration.

5. (a) Continuity of sedimentation through the boundary interval — preferably a marine succession without major facies change. A continuous monofacial (or with only rapidly alternating and repeating facies changes) will reduce possible errors resulting from stratigraphic gaps and biostratigraphic limitations due to the occurrence of facies fossils and appearances and disappearances associated with only environmental change and not to biological evolution of lineages.

(b) Completeness of exposure: not in an isolated position but with a succession which can be followed easily - above and below the GSSP and preferably laterally as well.

(c) Adequate thickness of sediments .

(d) Abundance and diversity of well-preserved fossils: appearances and disappearances of single fossil species can be expected to be diachronous and therefore a bad guide for the location of a GSSP. Multispecies fossil zones (e.g. faunal assemblages) may be preferable biostratigraphic signatures for GSSP guidance. Exclusion from consideration of taxa which are palaeoecologically tied to a facies would be the ideal although all fossils are to some extent facies fossils. In order to minimize possible effects of environmental controls on different fossil groups, recognition of the boundary level should preferably be based on all available faunal and floral data.

The selection of appropriate fossils will vary greatly in different parts of the geological column. Ideally selection of a point within an evolutionary lineage would be desirable but recognition of such lineages can be subjective and not necessarily more accurate than the recognition of a particular assemblage zone. Such decisions must be left to the experts in each case. The case for autochronology, i. e. a single species taken out of a phylogenetic lineage (with its predecessor and successor known in detail) as the biological way of approaching a boundary free of ecological, facial or sedimentary disturbing effect was given by WEDDIGE & ZIEGLER (1979).

(e) Favourable facies for development of widespread reliable and time-significant correlation horizons: this requires that the GSSP should not be in or close to conglomerates, breccias, olistostromes, turbidites or **remanié** deposits. This should, as far as possible, exclude variation of chronostratigraphic or chronometric age within the stratotype section near the stratotype point. Even if at the present stage of research, for example, fossils in derived blocks and surrounding matrix appear to be of the same age the danger exists that new techniques or new finds (palaeobiological or physical such as magnetostratigraphy) might discriminate between the blocks and matrix introducing as an unacceptable imprecision in the future. Even the "model" decision on the Silurian-Devonian Boundary has had, retrospectively at least, its weakness — the GSSP was placed within a turbidite on the basis of the "first" occurrence of a species. Nevertheless it is the first and longest-lived GSSP and no disrespect can be levelled.The boundary decision is internationally accepted. In 1985 it was sampled for magnetostratigraphic studies.

(f) Freedom from structural complication, metamorphism or other alteration: currently the question of exotic accreted terrains is pressing but the problem of the relationship between present and past position may not adversely affect global stratigraphy. Speculation here, which affects all historical geology, does not need to lead to despair or defeatism.

(g) Freedom from unconformities: an obvious boundary should be suspect. Either it is too obvious because there is a marked change in lithology or because there is a marked change in fauna or flora. In either instance the change may imply a time break, and consequently an unsuitable horizon at which to fix any time definition; no disconformities, unconformities, cryptic paraconformities or time-breaks in sedimentation any longer than a brief diastem can be tolerated close to a GSSP.

(h) Amenability to magnetostratigraphy and geochronometry. Although these factors are mentioned last they are probably the most important for future work and some would argue that no GSSP should be accepted without one or both.

6. One of the main aims of the Boundary stratotype procedure of ICS is to attain a common language of stratigraphy that will serve geologists worldwide and to avoid the dissipation of energy in petty argument and unproductive controversy. Development of a standard global stratigraphic scale which is stable for a considerable period of time is the objective here. Testing can then proceed. If new developments demand revision it will be set in motion by ICS if a majoritiy (50 % + 1) of the Voting Members of ICS support the setting up of a new Working Group. In any case only in very exceptional circumstances will this be entertained until the next International Geological Congress (IGC) but one after the ratification of a GSSP (at present at the 1992 IGC in Tokyo, Japan). Very exceptional circumstances could include: — (i) permanent destruction or inaccessibility of an established stratotype, (ii) violation of accepted stratigraphic principles as clearly agreed by ICS.

Correlation of GSSP with elsewhere: the prefix global means, of course, that intercontinental correlation and with different facies must have been achieved. Choice of GSSP by working groups may involve an interrelated series of decisions in order to achieve optimum acceptibility. In the overwhelming majority of cases in the Phanerozoic Eon (ICS is concerned with all Eons) correlation must precede the definition of a boundary but unless preliminary choices are made it may be that progress will be slow as the process of testing a candidate or the competition between candidates may be the required stimulus for the desirable improvement of needed correlation techniques and correlation itself. Correlation must precede the selection of boundary stratotype candidates to a considerable extent but in practice the sequence may be reversed. The finding of the best level and geographical site may have to go on side by side for a time. The choice between two more or less equally suitable boundary levels may be influenced by the availability of a better GSSP for one of them. Correlation to a satisfactory degree is necessary but improvements in correlation should continue after a boundary stratotype has been selected. In this context of correlation (actual at present and with future potential) an ideal GSSP would have the maximum possible correlation by magnetostratigraphic and geochronometric methods: this is of increasing importance for future work. In reality there is probably no GSSP in existence which can satisfy all desired criteria. Compromise

seems inevitable if progress is to be made with the global stratigraphic scale. In the Phanerozoic Eon (and with the Precambrian-Cambrian Boundary also) the prime polarity factor being biological evolution, boundaries will normally be guided in their definition by chronostratigraphy (mainly biostratigraphy) but in the Proterozoic and Archean Eons the guidance will be chronometric at the present stage of research. Chronostratigraphy can be expected to be used increasingly for boundaries late within the Precambrian successions.

Because of the multiplicity of criteria involved and the variation in circumstances through the geological time scale it would be unwise (or impossible) to specify which criteria are essential and which are desirable up and down the scale. Expert assessment must be the responsibility of the appropriate experts in that field of study. It is unlikely that all boundary stratotypes will possess all criteria and some compromise must be expected.

7. Accessibility and Conservation: these two topics are contrasting but complementary factors (two sides of the same coin). Recent experience has shown that if access to an important outcrop is too easy and unrestricted then excessive collecting, even vandalism and plunder, may destroy the outcrop. Conservation and some restriction is therefore necessary in developed regions. Conservation in more remote regions may be easier but this depends on regional geological activity (with helicopters maybe) by outsiders. A stratotype in a large disused quarry may seem ideal until planning permission is given in its urban area for garbage-dumping. In some countries large holes in the ground are at a premium for the growing mountains of garbage which are a costly disposal problem to authorities.

A problem for conservation/access may be weathering which in some cases may be rapid and caused by heavy rainfall forming rapid mud-flows from, for example, a marly sequence. Frost may form screes which can soon cover an outcrop. Outcrops on sea coasts may be subject to very rapid erosion. All are factors which must be considered when choosing a GSSP.

There must be no insuperable physical and/or political obstacles for access by geologists of any nation; without great expense and ideally without much bureaucracy. At the International Geological Congress in Moscow (1984) the plenary session of ICS agreed that a reasonable amount of collecting must be possible at a stratotype section. Although it is difficult for any group of geologists to commit any nation or organization to guarantee access and conservation for the indefinite future, total accessibility must assume considerable importance. One important safeguard is that if there is some prestige and responsibility in being "host" to a Global Stratotype Section and Point (GSSP) then that may in itself guarantee access and conservation. If a GSSP is found not to be accessible in the future this would be a very powerful argument for a reassessment of the geographic location. In a Submission of a GSSP to ICS all these factors should be discussed in detail as far as is feasible.

8. There is a metamorphosis once a GSSP has been ratified by IUGS:

(i) Beforehand all methods of correlation are enlisted to define a globally valid boundary stratotype section and point between what is decided should belong to System X or System Y.

(ii) After the decision the GSSP can be used to indicate without ambiguity what constitutes earliest System X and latest System Y. Correlation has in any case to precede the definition of a GSSP. Possibilities of correlation should be, of course, tested simultaneously at different levels close to the boundary being defined. The most suitable level would then be chosen as the boundary level and strictly defined by a GSSP, becoming thus the only standard of reference.

There is no conflict between the global boundary stratotype concept and global, isochronous, event stratigraphy. The combination of global environmental change and major biotic changes (which may be caused by biological evolution) brings together lithostratigraphy and biostratigraphy to provide event stratigraphy. Stratotypes bring stability through an agreed point in rock representing a unique instant of time (cf. BERRY 1984). The ultimate reference is to rock and not to abstractions.

In this work in the past decade or two much inspiration and guidance has been derived by the international geological community from the brilliantly-expressed published results of the Silurian-Devonian Boundary Committee (MCLAREN, 1977), which have the great virtue of being based on practical experience in actually defining a GSSP. One recommendation made by this committee was that, in the case of the Silurian-Devonian Boundary, the "horizon chosen defines the base of the Devonian, and not necessarily the top of the Silurian. Should it subsequently be shown that the selected horizon is at the level of an undetected time break or hiatus, unrepresented by sedimentation in the section, then the time missing would, by definition belong to the Silurian". (MCLAREN, 1977: 20).

Although there is no scientific principle involved in considering the base of a unit any more important than the top of a stratigraphic unit, ICS bodies (e. g. Subcommissions) are responsible by convention for the base of their units.

Boundary Working Groups set up by ICS or its constituent bodies must, however, include experts on the unit below as well as experts on the unit above. Hence the appellation of intersystem working groups is the composite term e. g. Silurian-Devonian, Jurassic-Cretaceous etc. The convention that chronostratigraphic units are defined by their lower boundary (which automatically becomes the upper boundary of the underlying unit) is intended to guarantee the creation of a time scale of contiguous units with no man-made gaps or overlaps. This is also one of the justifications for the preference for boundary stratotypes and not unit or composite stratotypes (HEDBERG et al. 1976).

After ratification of the Silurian-Devonian Boundary stratotype in 1972 a period of great activity by ICS and its bodies has resulted in the ratification in 1985 by ICS and IUGS of a number of boundary stratotypes (Ordovician-Silurian; Series and Stages of the Silurian System; Series of the Devonian System; Pliocene-Pleistocene) (BASSETT, 1985).

The submissions to ICS for these and other stratigraphic boundaries illustrate well the substantial progress which has been made during the past 13 years, but there is an undeniable heterogeneity in the format and quality of the presentations and hence the need for the formulation of these guidelines. Guidelines have to reconcile conflicting demands: freedom of scientific opinion and free choice of methods of correlation on one side and a reasonable unified procedure which ensures that the basic questions are answered. It is essential that the general geologist is helped and not just the specialist stratigrapher. The method of ratification by the Voting Members of ICS (representing the whole field of stratigraphy) and by the IUGS Executive (representing all aspects of the geological sciences) means a submission to ICS should clearly summarise all relevant points and be expressed in a cogently organized format. The vital minimum of agreement concerning general problems of procedure is here given with a set of rather precise technical recommendations about how to present submissions of stratotypes.

It is essential that, although there is a geographic component in all opinions, agreement under ICS is sought in an international manner, excluding considerations tied to a region or, in the main, other than those which are scientific. It is therefore strongly stressed that in the work of ICS members are scientists who are involved in an individual capacity.

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Appendix I:

Brief CHECK-LIST for criteria used in selection of a GLOBAL STRATOTYPE SECTION AND POINT(GSSP) under ICS Guidelines.

1. Explicit motivation for the preference
2. Correlation on a global scale
3. Completeness of exposure
4. Adequate thickness of sediments
5. Abundance and diversity of well-preserved fossils
6. Favourable facies for widespread correlation
7. Freedom from structural complication and metamorphism
8. Amenability to magnetostratigraphy and geochronometry
9. Accessibility and conservation

Superseded by new edition

Statutes

of the International Commission on Stratigraphy

C. Statutes

The International Commission on Stratigraphy (ICS) is a commission of the International Union of Geological Sciences (IUGS).

Contents

1. Name

The Commission shall be known as the International Commission on Stratigraphy (ICS) hereinafter referred to as ICS. The International Union of Geological Sciences is hereinafter referred to as IUGS.

2. Purpose and Objectives

The purpose of the Commission is to promote international cooperation in stratigraphy. Among its objectives are:

(a) to clarify principles of stratigraphic procedure and unification of stratigraphic nomenclature.

(b) to develop and to elaborate on a standard global stratigraphic scale, to distribute stratigraphic information on each of the major subdivisions of the standard scale, to establish their boundaries, and to correlate their subdivisions and to prepare correlation charts with explanatory notes, stratigraphic lexicons and glossaries.

(c) to develop and apply stratigraphic methods of all kinds — physical, chemical and biological.

3. Composition

The Commission shall appoint such Subcommissions, Regional Committees, Working Groups, and Committees as it considers necessary to carry out its purposes. These subordinate bodies are defined as follows:

Subcommissions are bodies within the Commission of unlimited duration, created for the study and investigation of general aspects of stratigraphy or of the major subdivisions of the standard scale over the world;

Regional Committees are bodies within the Commissions or its Subcommissions of unlimited duration, created for the study of the major subdivisions of the standard scale in a limited region;

Working Groups are bodies within the Commission or its Subcommissions constituted to carry out specific tasks of limited duration, or in a limited area of specialization.

Committees are small bodies created for specific administrative or organizational tasks which may lead to the setting up of a new Subcommission, Regional Committee or Working Group.

4. Membership

Three categories of Members may adhere to the Commission:

Members (Voting Members) of the Commission shall be the officers of the Commission and the Chairmen of the Subcommissions. Members shall be elected by the Council of the IUGS on the proposal of the members of IUGS or the Executive Committee of IUGS. The elected members shall hold office from the end of the ordinary session of the Council at which they were elected to the end of the following session. The term corresponds to the time between the International Geological Congresses, normally every four years. All members shall be eligible for re-election with the exception of the Chairman of the Commission and the Chairmen of Subcommissions who may be re-elected only once. The Commission shall itself propose to the IUGS Executive Committee candidates for membership and officers. All members shall have one vote only at the regularly held Commission meeting as provided for in Article 7.

Associate Members of the Commission shall be the chairmen of Working Groups and Regional Committees of the Commission. They shall be entitled to attend and participate in all meetings of the Commission but shall not be voting members of the Commission. They shall be confirmed by vote of the Commission and their term of office shall be the normal four year period between International Congresses. They shall be eligible for re-election.

Corresponding Members (Correspondents) of the Commission shall be those, other than Members or Associate Members, whose continuing advice is considered to be particularly helpful to the Commission. Correspondents shall be appointed by the Chairman of the Commission in consultation with the Bureau and subject to confirmation by the Commission. Appropriate international and national bodies may propose Correspondents. Correspondents shall be eligible for re-appointment. They shall be kept informed of the work of the Commission and may attend its meetings.

5. Officers and Bureau

5.1 Officers

The officers of the Commission shall be the Chairman, Past Chairman, two Vice-Chairmen, and the Secretary General.

5.2 The Bureau

The officers of the Commission shall constitute its Bureau, which shall act as advisor to the Chairman. The Chairman shall consult with other members of the Bureau on matters of major policy either by correspondence or at meetings. The Bureau shall meet at the request of the Chairman or of any two other members of the Bureau.

5.3 Chairman

The Chairman shall be the chief executive officer of the Commisssion and shall have general control over its activities within the scope of authority given by the Commission. The Chairman shall submit an annual written progress, financial and administrative report of the activities of the Commission to the IUGS Executive Committee prior to the IUGS Executive Committee's annual meeting. The Chairman shall submit a comprehensive report to the Council prior to each ordinary session of the Council.

5.4 Past Chairman or Past Secretary General

The Past Chairman or past Secretary General (if the past Chairman is unable or unwilling to serve) shall be a member of the Bureau and shall serve as an advisor to the Chairman.

5.5 Secretary General

The Secretary General shall be a member of the Bureau, shall aid the Chairman in the administrative work of the Commission, and shall keep the minutes of meetings of the Commission and its bureau and the financial accounts of the Commission.

6. The Nominating Committee

Twelve months prior to the regular meeting of the Commission at the International Geological Congress, the Chairman of the Commission shall appoint a Nominating Committee. After two months' consultation, the Nominating Committee shall prepare a list of one or more candidates for Chairman and for First Vice-Chairman for submission to the Commission. The Commission shall then, by written ballot, decide on its nominees for these offices and submit them to the Executive Committee of the IUGS. The Past Chairman or Past Secretary General (see 5.4) takes office automatically. The Second Vice-Chairman shall be designated by the Organizing Committee of the next following International Geological Congress. The Secretary General shall be chosen by the Commission, on recommendation of the Chairman-elect.

7. Meetings

The Commission shall meet regularly at the International Geological Congress normally held every four years. Additional meetings may be called by the Chairman with the advice of other members of the Bureau. Between such meetings, the Chairman may take any action with the advice of the Bureau necessary for the administration of the Commission, in accordance with Article 5.3.

8. Subcommissions

8.1
Each Subcommission shall have a Chairman who shall automatically be a member of the Commission. Each Subcommission shall also have a Vice-Chairman or Secretary or both. The officers of a Subcommission after its initial organization, shall be nominated by the members of the Subcommission, elected by the Commission, and ratified by the IUGS Executive Committee. The Chairman may be re-elected only once after his first term of office of normally four years. Terms of office for all other officers and all members of the Subcommission shall be the period from one International Geological Congress to the next, normally four years, and they shall be eligible for re-election. Each Subcommission shall present to the Commission its designated nominations for officers nine months prior to the Commission's regular meeting. Additions to voting membership must be approved by the Chairman of the Commission, acting with the advice of the Bureau. Membership may be cancelled if a member fails to participate in the work of the Subcommission and to consistently fail to respond to correspondence from the officers.

8.2
New Subcommissions may be organized by decision of the Commission with the approval of the IUGS Executive Committee. The inital members and officers of a new Subcommission shall be proposed to the Commission by the Chairman of the Commission after consultation with the Bureau and after opportunity for suggestions has been given to appropriate Bodies of the IUGS. The Commission shall then elect the initial members and officers from these or other nominations, subject to confirmation by the IUGS Executive Committee. Initial members of a new Subcommission shall be Chairman, Vice-Chairman or Secretary or both, and no more than thirteen other voting members, this may be increased later; there is no set limit to numbers of members.

8.3
Subcommissions shall endeavour to hold at least one meeting every four years, during the International Geological Congress.

8.4
Subcommissions may appoint or elect Correspondents in addition to their members. Correspondents shall not be voting members but shall be privileged to attend meetings of the Subcommission, and to be kept informed on its work.

8.5
The Chairman of a Subcommission shall submit an annual report on the activities of the Subcommission and its Regional Committees, and its plans for the next year to the Chairman of the Commission no later than December 1st of each year. This report should be accompanied by a financial account and a budget estimate for the coming calendar year; a copy of the financial account and budget estimate should also be sent to IUGS. The Chairman shall also report on the activities of his Subcommission at the regular meetings of the Commission.

9. Regional Committees

9.1
The Commission or its Subcommissions may constitute Regional Committees to study stratigraphic problems in a particular continent or region. The initial members of a Regional Committee shall be proposed to the Commission by the Chairman of the Commission or by the Chairman of the interested Subcommission or Subcommissions. These members will then elect their own officers, subject to confirmation by the Commission. The term of a member of a Regional Committee shall be the period between International Geological Congresses; members shall be eligible for re-appointment.

9.2
The officers of a Regional Committee shall be its Chairman and such other officers as it considers necessary. These officers shall be elected by the Regional Committee and confirmed by the Commission. Their terms of office shall be the period between International Geological Congresses. They shall be eligible for re-election.

9.3
Regional Committees may elect Correspondents in addition to their regular members.

9.4
The Chairman of a Regional Committee shall submit an annual report on the activities of the Regional Committee to the Chairman of the Commission and to the Chairman of the pertinent Subcommissions no later than December 1st of each year. This report should be accompanied by a budget estimate for the coming year.

10. Working Groups

10.1
The Commission or one or more Subcommissions or Regional Committees may constitute Working Groups to carry out specific tasks connected with their scientific objectives. The initial voting members of a Working Group shall be proposed to the Commission by the Chairman of the Commission or by the Chairman of the interested Subcommission or Subcommissions. These members will then elect their own officers, subject to confirmation by the Commission. The term of a member of a Working Group shall be the period between International Geological Congresses; members shall be eligible for re-appointment.

10.2
The officers of a Working Group shall be its Chairman and such other officers as it considers necessary. These officers shall be elected by the Working Group and confirmed by the Commission. Their terms of office shall be the period between International Geological Congresses. They shall be eligible for re-election.

10.3
Working Groups may elect Correspondents in addition to their voting members. They shall not vote but shall be kept informed of the Working Group activities and may attend its meetings.

10.4
The Chairman of a Working Group shall submit an annual report on the activities of the Working Group and financial accounts to the Chairman of the Commission and to the Chairmen of the pertinent Subcommissions no later than December 1st of each year. This report should be accompanied by a budget estimate for the coming year and current membership lists and addresses.

11. Committees

Committees are small groups of geologists chosen for administrative or organizational work assignments. Committees of the Commission shall be appointed by the Chairman of the Commission. Committees of Subcommissions or Working Groups shall be appointed by Chairmen of the Subcommissions. Preliminary work by a Committee could lead to its transformation into a Subcommission, Regional Committee or Working Group.

12. Entry into force of and amendments to Statutes

These Statutes shall come into force as soon as they have been approved by the Commission and the IUGS Executive Committee.The original text shall be the English version approved by the IUGS Executive Committee. The Statutes may be amended by a majority (50% + 1) vote of the Commission, subject to ratification by the IUGS.

Bureau ICS:

J. W. COWIE, Chairman
W. ZIEGLER, 1st Vice-Chairman
A. J. BOUCOT, 2nd Vice-Chairman
J. REMANE, Secretary-General
M. G. BASSETT, Past Secretary-General

February 1986

Ratified by the Executive Committee of IUGS at the annual meeting in Washington, D. C., U. S. A. in February 1986.