Guidelines and proforma for a GSSP/GSSA proposal to the ICS

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This document provides the suggested format for any Global Stratotype Section and Point (GSSP) or Global Stratotype Standard Age (GSSA) proposal for consideration and voting by the International Commission on Stratigraphy (ICS) followed by ratification by the International Union of Geological Sciences (IUGS). The document has been designed to:

1. Ensure that ICS and IUGS voting members can focus on the key criteria of the GSSP/GSSA proposal;
2. Allow authors a smooth transition into a manuscript for submission to *Episodes*.

Please note:

- The template for proposals has been arranged in a logical scientific order, please retain where possible.
- Whilst a primary marker must be selected, we note that the secondary markers are also critical for correlation. Please therefore balance the presentation in terms of the primary and suite of secondary markers.
- In choosing a position and point for the stratotype, the correlation potential should be considered first and then the definition. For instance, a section that has biota from different provinces, or preserves a global geochemical signal.
- Overall, the proposal should be around 20,000 words or figure equivalents. Assume a full-page figure is about 1000 words.
- This document can be used as a template. Styles are set up in Microsoft Word. Notes are shown as: [grey note]. Please retain or insert the line numbers
- Please document uncertainties and alternative interpretations.
- The full GSSP/GSSA approval process, including a flow chart, is outlined in a straightforward fashion in Section 13.5 of Harper et al., 2022.

Critical resources for identifying a GSSP/GSSA and/or the procedure for ratification:

Remane, J., Basset, M.G., Cowie, J. W., Gohrbrandt, K. H., Lane, H. R., Michelsen, O. and Wang Naiwen, 1996, Revised guidelines for the establishment of global chronostratigraphic standards by the International Commission on Stratigraphy (ICS). Episodes, v. 19, pp. 77–81. https://doi.org/10.188814/epiiugs/1996/v19i3/007

Harper, D.A.T., Bown, P. B. and Coe, A.L., 2022, Chronostratigraphy: Understanding rocks and time. In: Coe, A. L. (ed.) 2022. Deciphering Earth's History: the Practice of

Stratigraphy. Geological Society, London, Geoscience in Practice, 213–226. https://doi.org/10.1144/GIP-2022-38

Head, M.J., Aubry, M-P., Piller, W.E. and Walker, M, 2022, Standard Auxiliary Boundary Stratotype (SABS) approved to support the Global boundary Stratotype Section and Point (GSSP). Episodes, v. 46, pp. 99-100.

Murphy, M. A. Salvador, A., Piller, W.E. and Aubry, M-P., no date, International Stratigraphic Guide-an abridged version. Available at: https://stratigraphy.org/guide/ [accessed 4th February 2025]

Referenced below:

Barry, T. L. and Condon D.J., 2022, Geochronology: radio-isotope dating applied to the stratigraphical record. In: Coe, A. L. (ed.) 2022. Deciphering Earth's History: the Practice of Stratigraphy. Geological Society, London, Geoscience in Practice, 245-260. https://doi.org/10.1144/GIP-2022-45

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Coe, A.L., Erba, E, Henderson, C.M. 2025. Guidelines and proforma for a GSSP/GSSA proposal to the ICS. Available at: https://stratigraphy.org/gssps [Accessed DATE]

Title e.g. 'Global Stratotype Section and Point (GSSP) for the X Stage (Series/System)'

[Authors names and addresses. Corresponding author identified.]

Summary of voting

This section is for ICS and IUGS purposes. Once ratified, the voting results can be summarized within the introduction of a subsequent *Episodes* article.

Working group:

[Include the exact wording of the motion for the vote, number for, against and abstentions]

Subcommission:

[Include the exact wording of the motion for the vote, number for, against and abstentions]

Abstract

[A 300-word abstract containing the exact stratigraphical position and geographical place of the GSSP. This should include co-ordinates. Explanation of both the primary marker and all of the key secondary marks. Any other relevant information, e.g. global correlation and auxiliary stratotype(s). If this is a new stage the abstract should start with a sentence on the name of that proposed stage.]

Graphical abstract

[Provide a full-page figure summarising the key datasets from the proposed stratotype and showing the position of the GSSP. The boundary must be placed in stratigraphical context, usually about 500 ka years either side of the proposed boundary is sufficient. Below is a figure caption. This is for ICS and IUGS and we recommend including it in the conclusions for the final publication in *Episodes*.]

Figure 1. A summary of the data to support the position of the GSSP proposed for the X Stage.

Non-technical summary

[Provide a 300-word non-technical summary suitable for a general audience]

Introduction

[Provide any general introductory geological comments. At the end include sentence along the lines of: Here we present evidence and a proposal for a GSSP/GSSA at [place] based on [stratigraphical technique e.g. ammonite biostratigraphy or cyclostratigraphy] using [marker] as the primary marker and [number] secondary markers.

If this proposal presents one or more SABS as well as a primary section also state this in one sentence here.]

Background

[Provide a brief overview of the historical perspective of the boundary summarising for the reader the key decisions and motivation for the present proposal. Include brief comments on any former usage of the boundary level (Section 5, Remane et al., 1996).]

In case of the need for further subdivision. This is a heading 4.

Geological and geographical setting

[Provide information on the overall context, including the exact location. Provide a topographical map and a geological map (Section 5.1, Remane et al., 1996). This part of the proposal should also contain the following subheadings:]

Depositional environment and palaeogeography

[Give an overview of the depositional setting and where appropriate provide a palaeogeographical map. The map should also show other sections referred to under the subheading correlation.]

Sedimentary facies, stratigraphical completeness, sedimentation rate and sequence stratigraphy

[Present a graphic log and photographs of the succession showing the stratigraphical facies. Focus on possible hiatuses and condensed intervals at all levels of resolution within the section; including changes in facies (Section 4.2, Remane et al., 1996). The sequence stratigraphical analysis should provide a framework in which to discuss hiatuses and changes in sedimentation to avoid significant levels of condensation. Harper et al., 2022 (Section 13.5.4, point 6) considered that the optimal position for a GSSP was the 'lowermost [part of the] highstand systems tract as this is most likely to be preserved over the widest area', but it is acknowledged that a position within the transgressive systems tract may be optimal for some taxa. Open marine environments often provide the most favourable environment for wide geographic range of fossils (Section 4.2, Remane et al., 1996). Reference any biostratigraphy or other age control that indicates continuous sedimentation, a change in sedimentation rate or hiatuses. Reference any cyclostratigraphical analysis if that provides detailed sedimentation rates.]

Adequate exposure thickness

[Provide details on the exposure, including how much in both thickness and estimated time is preserved, and details on the permanency of the exposure containing the proposed stratotype. Care should be taken to show that there is enough exposure for future research and sampling (Point 7, Section 13.5.4, Harper et al., 2022). If the GSSP is in material that is not a rock exposure, or supported by such material (e.g. borehole cores), the adequacy for (i) stratigraphical context and (ii) future research and sampling should be outlined.]

Absence of synsedimentary and tectonic disturbances

[Provide details of any structural features and where there is evidence of synsedimentary movement that influences the continuity of the proposed section.]

Absence of metamorphism and strong diagenetic control

[Identification of magnetic and diagenetically sensitive geochemical signatures is a good indication of the lack of primary signal overprinting.]

Primary marker

[The point should be chosen 'where the sedimentation is as complete as possible from the options available' (Point 6, Section 13.5.4, Harper et al., 2022) using a marker of 'optimum correlation potential' (Section 3.2, Remane et al. 1996). Clearly identify the primary marker[1] and provide the scientific justification for the marker. Any background on the primary marker should have already been published. For example, for a biostratigraphical marker definition of new taxa (species); or the data, interpretation and uncertainties for physical/chemical marker such as cyclostratigraphical analysis or radio-isotopic dates or chemostratigraphy. This part of the proposal should focus on the reasons why this marker has been chosen, provide an overview and reference the relevant literature. Wording should be careful to note that the point is **defined** and **marked** by the primary marker **only** at the stratotype section. The chosen point defines the boundary, thus in other sections the primary marker may not coincide exactly stratigraphically with the GSSP level. The primary marker should work in conjunction with the secondary markers such that, as stated in Section 4 of Remane et al. (1996), 'the stratotype-section contains the best possible record of the relevant marker events'.]

Secondary markers and correlation

[Provide systematic information on all the other secondary markers, this and the 'Primary marker' subsection usually cover *all* of the following as critical techniques for stratigraphical correlation. Where it has not been possible to obtain data, for instance because there is no material suitable for radio-isotopic dating or no funds/ expertise for cyclostratigraphy please provide a brief explanation. This will show all methods have been considered and prevent further questions. It is good practice to have published all these data in advance via peer reviewed specialist journals, but it is acknowledged that the proposal may occasionally introduce some supplementary or new data. Include data for as many secondary markers as possible (Point 11, Section 13.5.4, Harper et al., 2022).] This full list is for ICS and IUGS; for publication in *Episodes*, methods that cannot or have not been applied can be combined. Wording such as 'cyclostratigraphy awaits further studies' may be appropriate. Keep in mind that secondary markers may well provide better or equal means of stratigraphical correlation than the primary marker in some areas.

Biostratigraphy

[This part of the proposal is likely to have several subsections, one for each fossil group. Illustrate key taxa for the proposed boundary from all the main fossils groups either in the main proposal or supplementary information. Ensure that any new marker species

[1] The primary marker should be the one that provides fine-scale stratigraphical definition at the point and is the most reliable and reproducible at the stratotype. It is worth bearing in mind that all markers are important and that the scientific merits as a primary marker must outweigh any specialist favouritism or historical preference.

are published. Section 4.2 of Remane et al., 1996, calls for 'abundant and diverse biota' however this needs to balance against possible concentration of fossils due to reductions in sedimentation rate or intervals of time when diversity levels are low. Provide an explanation if there are exceptional circumstances why this is not possible.]

Chemostratigraphy

[Often carbon- and strontium-isotope stratigraphy, but anything that is relevant. Provide an explanation if not possible.]

Magnetostratigraphy

[Including correlation to the marine magnetic anomaly chrons where appropriate. Provide an explanation if not possible.]

Cyclostratigraphy

[Include details of the main cycles identified through time series analysis. If there are alternative solutions provide information. Where relevant comment on the fit to the orbital solution. Provide an explanation if not possible.]

Radio-isotopic dating

[Provide details of the key horizons, dates, and uncertainties (relating to all of those associated with analytical measurements, reference material calibrations and, decay constants; Barry and Condon, 2022). Ensure the metadata and interpretation are documented in either the referenced paper or in the appendices to allow assessment by others and importantly for alternative interpretations (e.g. if the decay constant changes). Provide an explanation if not possible.

Based on the proposal and any new radio-isotopic data, provide information on whether the numeric age of the boundary needs to be amended in the International Chronostratigraphic Chart.]

Correlation to other areas

[This is an important section. Focus on how the section and point presents the greatest potential for global correlation. Indicate, referring to the palaeogeographical map, present-day geography and possibly in a small table, how far away the primary and secondary markers can be used for identification of the boundary; noting they should at least be supra-regional in extent. Provide a summary of any other work on the correlation of the markers to different regions.]

Accessibility, protection and marker

[Brief summary of ownership and guarantee of permanent protection (Section 4.4, Remane et al., 1996). An indication of permanent free access rights for research for 'all stratigraphers regardless of nationality' (Section 4.4, Remane et al., 1996) without requirement for lots of resources (i.e. not in a remote area). Comments on a permanent marker for the boundary and how the section will be kept in good condition. Information here or elsewhere in the proposal on the archiving, secure storage and access of relevant samples for further study (Point 12, Section 13.5.4, Harper et al., 2022).]

OPTIONAL: Auxiliary stratotype

[Standard Auxiliary Boundary Stratotypes (SABS) are ratified by Subcommissions. It is therefore not necessary to propose auxiliary stratotypes, but if one has been agreed please provide a brief overview. Furthermore, if key data such as magnetostratigraphy cannot be obtained from the primary section this part of the proposal may form a critical part of the documentation. Organise this part of the proposal along similar lines as the main proposal noting that there is only one primary marker at the GSSP (Head et al., 2022. Ideally a SAB or SABSs are the subject of separate manuscripts.]

Conclusions

[Provide a summary of the key points including comments on any limitations.]

Acknowledgments

[Include acknowledgement of funding of IUGS funds provided through ICS.]

References

[We suggest that the reference style used by *Episodes* is followed to save further work. see https://www.episodes.org/content/contributors/for_author.html]

Supplementary information/ appendices

[Composition of the working group, including identification of the chair and secretary and any relevant information on organisation. This section may also include data tables, supplementary figures and supporting references. This will form supplementary information once it is submitted to *Episodes*.]

Title 'Global Standard Stratigraphic Age (GSSA) for the X Boundary (Eon/Era/Period)'

[For Global Standard Stratigraphic Age (GSSA) the boundary is theoretical. Thus, not all the criteria above will apply. The proposal should include the following from above:

- Title (see above)
- Summary of Voting (see above)
- Abstract (see above without co-ordinates)
- A summary diagram
- Introduction/background; particularly motivation for the choice and how this compares to any previous definitions
- Primary marker
- Secondary markers
- Correlation

This section will be developed further later.

Exceptional cases

[If this document does not cover the scenario being proposed (e.g. new series as well as a stage). Please contact the ICS executive for further advice on how to proceed before preparing a proposal.]