

Newsletter N° 22

Lyon, September 1994



A SUBCOMMISSION OF THE INTERNATIONAL
UNION OF GEOLOGICAL SCIENCES (I.U.G.S.)



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Chairman : **Raymond ENAY**
Secretary : **Charles MANGOLD**



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NEWSLETTER N° 22

a publication of the ISJS

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I. GENERAL NEWS



The next IVth International Congress on Jurassic Stratigraphy and Geology in Argentina, 15-17 October 1994, will give the best opportunity to meet together a large enough number of the members of the ISJS and the WG convenors. It will be the first real opportunity since the IInd Symposium in Poitiers, September 1991. We tried but we failed to organize ISJS and WG meetings in London, just when the W.J. ARKELL Symposium finished, only a very few peoples being present.

Newsletter n° 22 was planed for being published soon enough to be sent long before the Congress, e.g. before summer time. But we have had to request many time all the members, especially reports from the WG convenors and we were obliged to delay the issue at the risk of not success to perform in time.

We did not change our initial goal to focus *Newsletter* n° 22 on the activities of the WG and advancements concerning proposals for Boundary Stratotypes or GSSP, which is the main current work of the ISJS. Because we requested and requested again, we succeeded in receiving reports from nearly all the WG convenors. Only one is missing now... the last two being just arrived by the mid-August ! That is a real problem and a serious concern for the bureau and the whole Jurassic Subcommittee which appears as inactive !

We asked you also on Sequence Stratigraphy, on the request of the ICS chairperson. We received only two responses (see *Newsletter* n° 21) and we requested again for more answers. The number was increasing a few but not very much and so we are able to publish all the answers we received (see p. 58-64).

To complete your information, we also present a summary or copies of the documents we received from ICS or other Subcommittee and Committee, unless they would be already included in the above mentionned items. Some of them were previously sent to the members and/or the WG convenors and again we did not receive much answers...

In connection with the ICS activities, the chairperson has been asked for voting either on ICS inquiries or proposals, either on proposals for various GSSP from the concerned Subcommittees (see *Newsletter* n° 21, 7.3., p. 61-73 for example).

Another point concerns membership of the ISJS and WG convenors. Some changes are needed for various reasons : any asked themselves to be replaced, others are retired and seem to stopped activity, we do not have any sign of interest from a few others etc... We shall present the situation at he present time and the changes will be discussed in Mendoza.

New directives have been notified last year concerning annual report by ICS Subcommittees and ICS funding policy. A consolidated annual report of ICS is delivered to the IUGS by November 30. The ICS Bureau need to receive the reports from ICS Subcommittees not later than November 1, in order to be able to timely prepare the Commission's report.

For the same reason, report of all WG activities have to be sent to the ISJS by October 1. This is necessary to obtain financial support from the ICS. The reports have to be accompanied by explanation how money was spent and what are the applications and for which purposes for the money we request for the next year.

Concerning 1995, we shall use the reports we came to obtain for this *Newsletter* n° 22, but we need to receive applications concerning financial assistance.

The ISJS bureau needs more informations to prepare the next *Newsletter* and the annuary report for 1994 too. Surely they are many topics worked out or published on general or regional stratigraphy, sequence stratigraphy, biostratigraphy, palaeontology and ecology.

2. GSSPs



PLEASE SEND YOUR REPORTS, SUMMARIES ON YOUR ACTIVITIES, PUBLICATIONS OR REFERENCES BEFORE 15th OCTOBER 1994.

2. BOUNDARY STRATOTYPES (GSSP) FOR THE JURASSIC SERIE AND STAGES

Establishing boundary stratotypes (or GSSP) for the major chronostratigraphic units (System, Serie, Stage) remains the main task on which the ICS and its subcommissions are supposed to concentrate effort.

This date back to March 1986 when the board of the ICS, and especially its chairman J.W. Cowie edited new Guidelines and Statutes of the ICS (see *Cour. Forsch. Inst. Senckenberg*, Frankfurt a. M., 83, 1986 : 1-14).

We recall you the complete Guidelines were spread to the ISJS members in *Newsletter* issue, n° 14, June 1986 and the past chairman, A. Zeiss, tried also to find out the most important points and underlined them in a circular letter sent to all the WG Convenors in June 1986, with the copy of the Guidelines.

Revised Guidelines for the establishment of GSSP are currently in progress by the Bureau of the ICS. On one's side the ISSC (International Subcommission on Stratigraphic Classification) drafted an updated version of the Guidelines and circulated it for comments. The ICS thinks the drafting of the Guidelines does not fall within the scope of the ISSC and so, "the draft of the revised Guidelines (by the ICS) will be transmitted promptly after its consolidation to the constituent bodies of ICS for their input. The bureau will then prepare a final draft, the acceptance of which will be decided by vote of the Full Commission".

In a recent letter (dated August 18) the Chairman of the ICS wrote the Revised Guidelines will be presented during the Mendoza session. He adds (english translation by the bureau of the ISJS) : "the main part of the GSSP concept will not change (unless what does no longer apply to Precambrian Time). So unbroken sections (e.g. complete documentation) are needed, with facies change at the boundary (to avoid ecological ground noise in the biostratigraphy). And it would be needed to give a more larger place to the non-biostratigraphical tools (e.g. magnetostratigraphy)".

2.1. THE CURRENT SITUATION, EIGHT YEARS LATER

As A. Zeiss wrote "when we established the WG on the Jurassic stages in 1983, their tasks were summarized in a more general way (cooperative work on subdivision and correlation). They appear as the more important work to do within Jurassic Time".

Changing our way was not easy and the chairman remember WG field trips and/or meetings for which he was obliged to recall again the objective was the boundary stratotype and so to organize meeting in countries or areas which offer potential GSSP.

Progress or no progress will appear in the WG Convenors reports (see p. 9-54) to be compared with reports following the Poitiers Symposium (*Newsletter* n° 21). In the meantime, very few WG hold meeting and/or field trip on the matter.

Taking the opportunity of the WJ. ARKELL Symposium in London, September 1993, and owing to the friendship help and availability by J.K. WRIGHT, K. PAGE and B. COX a small party (ATROPS, ENAY, MARCHAND, MELENDEZ) was able to visit some potential boundary stratotypes for Oxfordian and Kimmeridgian stages in Yorkshire, Peterborough area and Dorset, but no formal meeting or discussion occurred.

During this year, two joint meetings took place. The first, in Marrakech and the High Atlas, Morocco, May 25-31, was held by the Aalenian and Bajocian WG (see the report by G. PAVIA & S. CRESTA, p. 00). Soon after, June 12-18, the Oxfordian and Kimmeridgian WG met in Lyon and SE France (see the reports by MELENDEZ and F. ATROPS (p. 43 and 46). The Secretary attended the first and the Chairman the second.

Proposal on the Callovian stage is currently in the same status quo situation. We only may expect formal proposals to be ready for 1996 (?) concerning Bajocian and Oxfordian Stages.

So, as a whole, the ISJS appears not very active. Previously, we informed all the WG convenors and members of the Subcommittee on the statements presented both in the report on plenary session of ICS during the 29th IGC in Kyoto and the report by the Chairman on the activity of the ICS Subcommittees (December 1993). The last comment in the minute of the business meeting of the bureau of the ICS (Neuchâtel, Switzerland, April 6-7) is as follows: "the (Jurassic) Subcommittee reported in its Annual Report no advances concerning the definition of Jurassic Stages stratotypes. The lack of any progress in this matter is of serious concern to the Bureau. The chairperson of Subcommittee is asked to discuss its work plans and time table with the ICS chairperson. The 4th International Congress on Jurassic Stratigraphy and Geology in Mendoza and Neuquen, Argentina in October will be attended by the chairperson and offers the opportunity of further coordination of the work progress".

The reasons of such few progress are of various kinds which probably intermingle each another. The first, often put forward (and we understand well, being in the same situation) is the lack of financial support for attending meetings and/or field trips. The few money they received, the peoples like best to use it for their own research purposes. This connects well with the second reason: many Jurassic workers are involved in works not directly linked with the boundary stratotypes project, sometimes providing financial support, but in exchange results have to be reached in time. The third and fourth reasons are connected with the (perhaps) peculiar situation we experienced in Jurassic Stratigraphy. On the one hand, since the 1st (1962) and 2nd (1967) Jurassic Colloque in Luxembourg, a good agreement exist, within the Jurassic specialists concerning almost the 11 Jurassic Stages, as well the individual extents as the boundaries; even the question of the uppermost Stage (and the related Kimmeridgian) received answer (see *Newsletter* n°19 & 20), although some rear-guard fights (see J.C.W. COPE paper, *Newsl. Stratigr.* 28(2/3), 1993, 151-156). On the other hand, basic problems being considered as solved, the main interest for Jurassic workers seems to be refined subdivisions, both in the historical reference areas and new countries (South America, South Asia and Australasia etc.) and correlations between different biogeographical realms and provinces. Exceptionnaly such correlations could concern also stages boundaries, e.g. the Oxfordian-Kimmeridgian boundary in Tethyan realm which increasingly (see report on the Kimmeridgian stage, p. 46) appears to have to be placed earlier than it was used until yet.

As we recall above, this was the task originally requested from the WG and this probably explains (in part) the few advance concerning definition and proposal of Jurassic Stages Boundary Stratotypes.

2.2. FUTURE OBJECTIVES AND ACHIEVEMENTS

As we informed you recently, we were asked by the ICS on the subject and we sent the answer just below :

- Planned achievements from 1994 to early 1996
 - Achievements of Boundary Stratotypes GSSP
 - . 1995 - Préparation of proposals by WG : Bajocian, Bathonian, Oxfordian.
 - . Late 1995 - Votes of the Subcommission on the proposals.
 - . Early 1996 - Presentation of proposals to the ICS.
 - Advances in studies for post 1996 proposals : Kimmeridgian and Tithonian Stages.
- Planned achievements from 1996 to early 2000.
 - Probably some problems remain to be solved concerning Kimmeridgian and Tithonian.
 - Uncertain work schedule concerning the remaining stages, owing the present poor advances of the study.

In fact, it depends first on the current situation concerning each WG and future activity :

- Some of them presented only a review on the potential GSSP both from literature or/and individual proposals. We recall, as A. Zeiss stated previously : "you (the convenors) are not bounded to previous individual or national decisions or proposals for (boundary) stratotypes, if they failed to provide sufficient faunistic or other evidences for a precise global correlation (see also requirement below)".

We ask the WG convenors to act actively for starting the procedure leading to proposals as soon as possible.

- Others tried and unfortunately failed to organize meeting or/and field trip on relevant potential GSSP because they received no or too few answers. We ask them to propose again a field meeting and to maintain it whatever would be the answers number.
- A few are reaching the step for formalized proposal and we ask the WG convenors to do so that the ISJS would be in a position to present GSSP proposal(s) to the ICS before the next IGC in Beijing, 1996. The Bajocian WG is just organizing a postal vote, the result of which will be acquired before the Mendoza meeting.

In this connection we think useful to explain the four steps we have to go beyond until the approval by IUGS, the first one being informal, the three others being defined in the Guidelines.

- The first step concerns stage WG and was well detailed in the past chairman review (June 1986) :

"Finding the way you are free, but the following steps are proposed :

1 - Revise list of members and complete or propose new members which can really contribute to the boundary stratotype problem. You can drop inactive members.

2 - Estimate the global correlation potential of already established correlation levels around the present stage boundary. If these fail in global correlation test the next higher or lower correlations levels. If you find it useful you can also arrange an inquiry to the members of your group.

3 - Propose the best levels with correlation charts and faunal range charts to the members of your group asking them for their opinion, their agreement or disagreement and/or their proposals of other possibilities and/or supplements (e.g. information on other markers).

Ask also for possible candidates for boundary sections and points due to the guidelines and requirements of ICS (see attached).

4 - Evaluate final proposals for correlation levels and boundary stratotypes and make proposals for the (next) meeting. If already earlier possible you can arrange a meeting to discuss those stratotype candidates which seem to correspond closest to the requirements of ICS. The Subcommittee will try to give you financial assistance. Applications must reach us at first of November each year. In case you have a good candidate already available arrange a good presentation to your members by mail and arrange a postal voting".

We add only some comments concerning voting which are founded on past experience within the ISJS : 1) all concerned peoples have to be able to vote and only postal voting (as requested above) fulfil this condition ; 2) anyhow voting will be informal, because there is no defined electorate (or Voting members), unless membership would have been defined in accordance with the above 1st ZEISS requirement ; 3) voting results are only given to support the proposal put forward by the WG.

- The second step concerns approval by the voting Members of the ICS on the basis of the complete report presented by the WG including all the potential GSSP studied and the proposal put forward by the WG. The individual votes of the Voting Members of the Subcommittee have to be at least 60 % in favour of the proposal.
- The third step concerns approval by the ICS. The proposal containing all informations which fulfil criteria to be met in choosing a GSSP is submitted to the ICS for review, comments and approval by its Voting Members. Proposal is accepted if 50 % + 1 of the ICS Voting Members approve.
- IUGS is concerned by the fourth and last step. Proposal is forwarded to the Directorate of the IUGS for discussion and approval at the next International Geological Congress. On approval by IUGS the GSSP is established.

But we just received from the chairman of the ICS the answer, dated August 18, to a previous letter, whom we pull out his opinion concerning votes :

"For the establishment of a GSSP, as previously, a succession of votes will be needed. For each step, a majority of 60 % in favour of the proposal is needed, otherwise we would be unable to make the grousers keep quiet. So, successively vote of the concerned WG and of the Subcommittee which will have to present the official proposal to the Full Commission. Lastly approval by the IUGS. To avoid endless carousel of concurrent stratotypes, the decisive votes will be given by "Yes", "No" or "Abstain" on only one candidate. Concerning the composition of the W.G., election of the Voting Members by the Subcommittee would give anyway a democratic basis".

We will have opportunity to discuss these different points in Mendoza.

Lastly, for your information, we include just below a short comment on GSSP by the chairman of ICS and the table summarizing the currently 20 established GSSPs (from *Neogene Newsletter* n° 1, July 1994, p. 13).

•••••

DEFINING CHRONOSTRATIGRAPHIC BOUNDARIES BY GLOBAL STRATOTYPE SECTIONS AND POINTS (GSSPs)

by Jürgen REMANE
Chairman of ICS, Univ. of Neuchâtel, Switzerland,

The first chronostratigraphic boundary to be defined by a boundary stratotype was the Silurian-Devonian boundary - or rather the base of the Devonian in 1972 (MARTINSSON 1977). Nothing happened until 1985, but then several boundaries were defined by boundary stratotypes, among them the base of the Pleistocene at Vrica, Italy (AGUIRRE & PASINI 1985). In the same time, the technique and the philosophy of the procedure were explained in the Guidelines of ICS (COWIE *et al.* 1986). Here the GSSP concept was developed, on the base of the experience gained from the definition of the base of the Devonian. At present 20 GSSPs have been defined (see Table 1). 17 of them stand for Paleozoic boundaries (including the base of the Cambrian), but no boundary has so far been formally defined neither in the Mesozoic nor in the Neogene !

The Guidelines of ICS are now under revision, mainly because the GSSP concept has proved to be inapplicable to the Precambrian in the absence of fossil markers. Proterozoic boundaries were therefore defined by absolute ages (see COWIE & BASSETT 1989), and Archean boundary definition will follow the same principle. For the Phanerozoic, the GSSP concept is, however, still entirely valid.

Its basic philosophy is rather simple : If the units of the geochronologic standard scale were defined through unit stratotypes, this would inevitably lead to gaps or overlaps, whereas succeeding units of the standard scale should be strictly contiguous. Therefore only chronostratigraphic boundaries are defined by a stratotype - a GSSP. A chronostratigraphic unit is thus defined by its lower boundary, which is automatically also the upper boundary of the underlying unit. This implies that we still have a certain number of "open" units whose upper boundary is still to be defined (e.g. the Paleogene). A GSSP is a point in the rock, thus fixing an instant of geologic time in the most precise manner which is possible. But how can we recognize the boundary elsewhere in the world ? As a matter of fact, the sole definition does not automatically guarantee a satisfying correlation potential for the boundary under question. This means that we have to find a suitable boundary level before proceeding to a formal boundary definition through a GSSP. Suitable means among other that the boundary we want to define should be as close as possible to prevalent traditional usage. But, as there is no priority regulation in chronostratigraphy, the most important point is that the boundary has an optimal correlation potential. The boundary definition will be guided by one boundary event, the first appearance of a fossil marker or a magnetic reversal, to give just two examples. But it is important to have a certain number of auxiliary markers near the boundary fossil species which occur also in facies of paleobiogeographic provinces where the primary marker is missing and which will then allow and approximate boundary determination. In this procedure as many methods as possible should be involved and non-biostratigraphic methods should be given more weight in the future (this is another point in the revision of the Guidelines).

The type section where the GSSP is to be placed has to fulfill certain requirements too, in order to give a correct representation of the succession of stratigraphic events which are important for the recognition of the boundary elsewhere. This means absence of gaps and condensation at or near the boundary. The GSSP should normally not be placed at a facies change, this would jeopardize the chronostratigraphic value of the biostratigraphic event underlying the boundary definition.

For non-stratigraphers it is difficult to understand that the establishment of a meaningful sGSSP is a time consuming task, because many sections in different parts of the world have to be studied in great detail. On the other hand, many stratigraphers have the tendency to postpone the final decision again and again, believing that one day the absolutely perfect GSSP will be discovered. What we need, is a reasonable compromise between a precipitate definition and the quest for the Holy Grail of utmost perfection. We should not forget that the standards for basic physical units as the meter and the second have been replaced when a better solution was at hand, so why not proceed in the same way in stratigraphy? 20 GSSPs for more than 100 Phanerozoic stage boundaries is not very much, better progress is urgently needed!

See Appendix 1.

References

- AGUIRRE, E. & PASINI, G. (1985) : The Pliocene-Pleistocene boundary. *Episodes* 8/2, p. 116-120.
- COWIE, W.J. & BASSETT, M.G. (1989) : Global stratigraphic chart.-Appendix to *Episodes* 12/2.
- COWIE, J.W., ZIEGLER, W., BOUCOT, A.J., BASSETT, M.G. & REMANE, J. (1986) : Guidelines and statutes of the International Commission on Stratigraphy (ICS). - *Courier Forsch.-Inst. Senckenberg* 83, 12 p.
- MARTINSSON, A., ed. (1977) : The Silurian-Devonian boundary.-IUGS Ser. A, n° 5, 349 p., Schweizerbart, Stuttgart.

2.3. REPORTS OF THE WORKING-GROUPS (WG)

TRIASSIC-JURASSIC BOUNDARY WORKING GROUP (TJBWG)

Chairman : Professor R. MOUTERDE, Université Catholique de Lyon
Secretary : Dr G. WARRINGTON, British Geological Survey

Report by the Secretary

1. A report on the TJBWG, prepared by the Chairman, appeared in *ISJS Newsletter* N° 21 (June 1993).
2. The Chairman and Secretary were unable to meet during 1993.
3. The Secretary accepted an invitation from the organisers of the "ARKELL" Symposium to lead and excursion to sections of the Late Triassic-Early Jurassic succession on the coasts

of West Somerset and South Wales in 1993. This excursion, which would have afforded participants the opportunity to visit several "classical" sections, including one at St Audrie's Bay, near Watchet, which has been proposed as a candidate Global Stratotype Section and Point (GSSP) for the base of the Hettangian, and thus of the Jurassic, was, unfortunately, cancelled without the knowledge of the Secretary who did not learn of the cancellation until it was too late to organise a substitute excursion under TJBWG auspices. A description of the Late Triassic–Early Jurassic succession exposed on the coast of the Bristol Channel in West Somerset, England, and in South and Mid Glamorgan, Wales, was in preparation for the excursion and will be published by the Geological Society of London in a volume comprising accounts prepared for all the planned "ARHELL" Symposium excursions.

4. The Secretary is a voting Member of the Subcommittee on Triassic Stratigraphy (STS) and provides a link between that group and the ISJS on matters of mutual interest. An invitation has been issued, in the STS newsletter *Albertiana*, for STS members actively studying Rhaetian sequences and the boundary with the Hettangian, but who are not also involved with the ISJS or TJBWG, to send summaries of their current work, results and views to the Secretary in order that the TJBWG is fully aware of all activity on the boundary successions. Responses have been received from workers in Canada and Mexico. Dr EMBRY (Calgary) has commented on the succession in the Sverdrup Basin, Arctic Canada, and advised of a forthcoming publication (EMBRY & SUNEY, *in press*). Dr GONZALEZ LEON (Hermosillo) is studying Late Triassic–Early Jurassic successions in the Sonora region, north-west Mexico; he advised of plans for a publication proposing a section in that area as a candidate GSSP for the base of the Jurassic.
5. The programme of the IVth International Jurassic Congress (IJC : Mendoza, Argentina) provides for business meetings of the ISJS working groups on 24 October and a TJBWG business meeting has been scheduled for that day.
6. It is 32 years since participants of the 1962 Luxembourg Jurassic Colloquium recommended that the Rhaetian Stage be placed in the Trias and that the "Zone of *Psiloceras planorbis*" should form the base of the Hettangian Stage, at the base of the Jurassic. It is 27 years since a British submission to the 1967 Luxembourg Jurassic Colloquium recommended the Watchet area of West Somerset, England, as the type area for the Planorbis Zone, and that a type section should be designated in the coastal exposures in that area. These recommendations form a basis for the definition of the base of the Hettangian Stage, and the Triassic–Jurassic boundary, and efforts must now be directed to the selection of a candidate GSSP that fulfils ICS guidelines (COWIE *et al.* 1986). Possibilities exist in Austria, Queen Charlotte Island (Canada), Great Britain, Nevada (USA)*, and Peru (Chairman's report, ISJS Newsletter n° 21) and Mexico (see 4, above). A section at St Audrie's Bay, near Watchet, West Somerset (Great Britain), has recently been proposed as a candidate GSSP (WARRINGTON *et al.*, 1994) and it is hoped that the appearance of this proposal will stimulate interest and activity in the documentation of other potential candidate sections, and progress towards the selection of a candidate GSSP. A proposal for a GSSP must be presented to the IUGS Executive Committee for ratification but the following stages of selection must first be carried out by the Working Group :
 - A. Compilation of a list of candidate sections, together with documentation of each section.
 - B. Conduct of an initial postal vote on all candidate sections.

* Recently G. GUÉX wrote to the Chairman R. MOUTERDE that he is preparing for 1995 his study on the fauna of T/J transition beds in Nevada (New York Cañon section).

- C. Conduct of a second postal vote to confirm the selection of the candidate section chosen outright or by a majority in the initial postal vote.
- D. Recommendation of the chosen candidate section to the ICS for its vote.
- E. Following a vote in favour by the ICS, consideration of the proposed section by the IUGS Executive Committee (leading to ratification of the proposal if accepted).

The TJBWG still needs to carry out the work necessary to achieve Stage A. It is therefore unrealistic to envisage the formulation of a proposal for presentation through the ICS to the IUGS Executive Committee before the 30th IGC (Beijing, 1996). However, 1996 may be a realistic target date for the completion of Stage A. The Secretary will be urging those involved with potential candidate GSSPs to endeavour to have proposals, supported by documentation, available for consideration by TJBWG members by 31 December 1995. The Secretary will be attending both the STS meeting which forms part of the "Shallow Tethys 4" Conference (Albrechtsberg, Austria) in September, and the 4 IJC in October, and will use these opportunities to promote this schedule. If this initial target can be met it should be possible to achieve ratification of a GSSP proposal by the year 2000.

References

- COWIE, J.W., ZIEGLER, W., BOUCOT, A.J., BASSETT, M.G. & REMANE, J. (1986) : Guidelines and statutes of the International Commission on Stratigraphy (ICS). - *Courier Forsch.-Inst. Senckenberg*, 83, 12 p.
- EMBRY, A. & SUNEY, L.B. *in press*. The Triassic-Jurassic boundary in the Sverdrup Basin, Arctic Canada. *Canadian Society of Petroleum Geologists, Memoir 17*.
- WARRINGTON, G., COPE, J.C.W. & IVIMEY-COOK, H.C. (1994) : St Audrie's Bay, Somerset, England : a candidate Global Stratotype Section and Point for the base of the Jurassic System. *Geological Magazine*, 131, 191-200.

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TRIASSIC-JURASSIC BOUNDARY WORKING GROUP

Chairman : Professor R. MOUTERDE, Université Catholique de Lyon
Secretary : Dr. G. WARRINGTON, British Geological Survey

A business meeting of the Triassic-Jurassic Boundary Working Group (TJBWG) will be held on 24th October 1994 as part of the 4th International Jurassic Congress (4IJC, Mendoza, Argentina ; the Agenda is given overleaf, together with a brief questionnaire.

I will be grateful if you will complete the questionnaire and mail or Fax it to reach me no later than Friday 7th October. If you are not able to attend the 4IJC but wish to express views relevant to items on the Agenda please mail or Fax your comments to reach me no later than Friday 7th October in order that they may be taken into account at the business meeting ; a summary of your current work, results, and recent and forthcoming publications relevant to the Triassic-Jurassic boundary will also be welcomed for inclusion in a newsletter planned for issue after the 4IJC.

If you are aware of anyone working on Triassic-Jurassic boundary sequences who has not received this notice it will be appreciated if you will copy it to them and note this on the questionnaire.

I look forward to hearing from you before 7th October, and hope to meet you in Mendoza.

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ADDITION TO THE TRIAS/JURASSIC BOUNDARY

by ISJS bureau

• To the report of the Intersystem Boundary Working Group on the Trias-Jurassic Boundary we add a few other references, some of them of papers in press, concerning Trias-Jurassic boundary in England, especially Somerset where is one candidate Global Stratotype Section and Point for the base of the Jurassic System (see WARRINGTON *et al.*, 1994).

From one of the papers in press by K.N. PAGE we extract the interesting figure here enclosed which "demonstrates the probable relationships between the ammonite faunas of the Triassic-Jurassic transition in West Somerset and those of other important areas of the world". See Appendix 2.

We think it would be useful as for the discussions in Mendoza.

References

- WARRINGTON, G., AUDLEY-CHARLES, M.G., ELLIOT, R.E., EVANS, W.B., IVIMEY-COOK, H.C., KENT, P.E., ROBINSON, P.L., SHOTTON, F.W. & TAYLOR, F.M. (1980) : A correlation of Triassic rocks of the British Isles. *Geol. Soc.*, London, Spec. Rep. n° 13.
- WARRINGTON, G. & IVIMEY-COOK, H.C. (1990) : Biostratigraphy of the Late Triassic and Early Jurassic : a review of type sections in Southern Britain. *Cahiers Univ. Catho. Lyon*, sér. Sc., 3 : 207-213.
- HALLAM, A. (1990) : Correlation of the Triassic-Jurassic Boundary in England and Austria. *J. Geol. Soc.*, London, 147 : 421-424.
- COPE, J.C.W. (1991) : Discussion on correlation of the Triassic-Jurassic boundary in England and Austria. *J. Geol. Soc.*, London, 148 : 420-422.
- POOLE, E. and COPE, J.C.W. (1991) : Further discussion on the correlation of the Triassic Jurassic boundary in England and Austria. *J. Geol. Soc.*, London, 148 : 943-944.
- WARRINGTON, G., COPE, J.C.W. & IVIMEY-COOK, H.C. (1994) : St Audrie's Bay, Somerset, England : a candidate Global Stratotype Section and Point for the base of the Jurassic system. *Geol. Mag.*, Cambridge Univ. Press. 131 (2) : 191-200.
- PAGE, K.N. (*in press*) : Preliminary observations on the ammonite faunas of the basal Jurassic in Somerset and their global context.
- PAGE, K.N., KING A. & GILBERTSON, D.D. (*in press*) : Field excursion to examine the Triassic-Jurassic transition in West Somerset and the Quaternary deposits of Doniford Bay, Watchet.

During the last Congress on Jurassic Stratigraphy in Poitiers, 1991, was called to mind the opportunity to visit another candidate Global Stratotype Section and Point for the base of the Jurassic System in North Peru. But on June 21, 1993 Prof. Dr. A.V. HILLEBRANDT wrote to R. MOUTERDE, Chairman of the TJWG :

"The 4th International Congress on Jurassic Stratigraphy and Geology takes place from October 15-26, 1994 in Mendoza and Neuquen, Argentina. At our last Congress in Poitiers you proposed to organize an excursion to the Utcubamba Valley in Northern Peru where the Triassic/Jura boundary is exposed with the best sections known for South America. These sections are only to be visit in dry season and not accessible in rainy season. The rainy season approximately starts in this region at the end of September and is ending in April. About these data I informed Dr. Riccardi in Poitiers. The period of the Congress is very inconvenient for a field excursion to the Utcubamba Valley and so, unfortunately, I can not organize it".

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SINEMURIAN WORKING GROUP (SWG)

Report by the convenor, G. BLOOS

In the years since the last report (1987) the following work has been done.

1 - The preparation of documentations of the ammonite faunas at the Hettangian-Sinemurian boundary. This is a necessary step and basic requirement for the choice of a GSSP. These documentations are not yet published. There have been published only lists of species at the base of the Sinemurian in Germany, France, and England. There are striking differences between these lists which are partly based on different interpretations of the species. So the systematical revision and documentation of the faunas is also a requirement for a harmonization of the determinations. Not earlier than after that harmonization a real comparison between the different regions is possible.

2 - Study of the early arietitids in NW Europe (Angulata Zone) and in the NE Alps (WÄHNER's Marmorea Zone). This work is necessary for the question if the Hettangian-Sinemurian boundary of NW Europe can be recognized in other faunal provinces.

The results (on base of revised, precised diagnoses) : the rich fauna of early arietitids in the NE Alps shows close affinities to arietitids of the NW European Angulata Zone (lower Conybeari Subzone), not only on specific but also on generic level. The fauna of the lower Conybeari Subzone of NW Europe is totally lacking in the few known localities of the NE Alps in which the boundary region is fossiliferous.

There is a single, isolated form in the Marmorea Zone which occurs also in the Sinemurian (upper Conybeari Subzone in NW Europe and WÄHNER's Rotiforme Zone in the NE Alps) : *Epammonites cordieri*. In the lower Conybeari Subzone of NW Europe other species of *Epammonites* occur : *E. latisulcatus*, *E. bonnardi*, *E. munieri*. It seems noteworthy that Sinemurian contemporary forms of *E. cordieri* are lacking in the Marmorea Zone. So it may be that this species appeared earlier in the Alps than in NW Europe. There exist other examples of different stratigraphical range of ammonites in NW Europe and the Alps. The reason : the first appearance must not be the time of immigration in NW Europe.

3 - Also the schlotheimiids of the Marmorea Zone have been revised ; unpublished material in different collections could be respected. There were found more relations to the NW European Angulata Zone than known before.

The new studies have underlined and precised the results of 1987. The abrupt appearance of the arietitid fauna of the lower Conybeari Subzone in NW Europe indicates an act of immigration. That means that the fauna must be expected also in the region of origin what is most probably the neighbouring Tethyan Province. The absence of the fauna there, at least in the few profiles which are fossiliferous in that stratigraphical region, indicates a gap. A fauna which seems closely related to the NW European lower Conybeari Subzone seems to occur in the North American Shoshone Mountains (Nevada) as to judge from the unpublished collection of D. TAYLOR (Portland/Oregon) which was presented to the participants of the excursion to the Jurassic of Oregon and Nevada in July 1989.

So, in spite of the fact that nowhere the boundary Hettangian-Sinemurian is so sharp as in NW Europe, there seems to be a good chance to maintain this boundary for a GSSP.

References

- BLOOS, G. (1988) : Reports on the working groups. Hettangian-Sinemurian. 2nd International Symposium on Jurassic Stratigraphy, pp. 9-11 ; Lisboa.
- BLOOS, G. (1988) : On the stage boundary Hettangian-Sinemurian in North-West Europe and in the North-Eastern Alps. 2nd International Symposium on Jurassic Stratigraphy, pp. 71-83, Lisboa.
- CORNA, M. & MOUTERDE, R. (1988) : Le Sinémurien de Semur (France). Essai de biozonation pour le Sinémurien inférieur et le Lotharingien du stratotype et du Jura Méridional. 2nd International Symposium on Jurassic Stratigraphy, pp. 101-117, Lisboa.
- GUÉRIN-FRANIATTE, S. (1988) : Corrélations biostratigraphiques dans le Lias inférieur du Bassin Parisien. Rapports avec l'ensemble du NW Européen. 2nd International Symposium on Jurassic Stratigraphy, pp. 85-100, Lisboa.
- PAGE, K. (1991) : On the sequence of ammonite-correlated chronostratigraphical horizons in the British Sinemurian (Lower Jurassic). 3rd International Symposium on Jurassic Stratigraphy, Poitiers (*in press*).

NEW OBSERVATIONS ON THE AMMONITE FAUNAS ACROSS THE HETTANGIAN-SINEMURIAN BOUNDARY IN SOUTH WEST BRITAIN : RESULTS OF AN EXCURSION OF THE SINEMURIAN WORKING GROUP

by K.N. PAGE

Abstract

New discoveries and a reassessment of latest Hettangian (Upper Angulata Zone) and earliest Sinemurian (lower Bucklandi Zone) ammonite faunas in Dorset, Somerset and Avon (South West England) as part of an excursion of the Sinemurian Working Group, have facilitated a revision of the sequence of biohorizons (i.e. intra-subzonal correlative units)

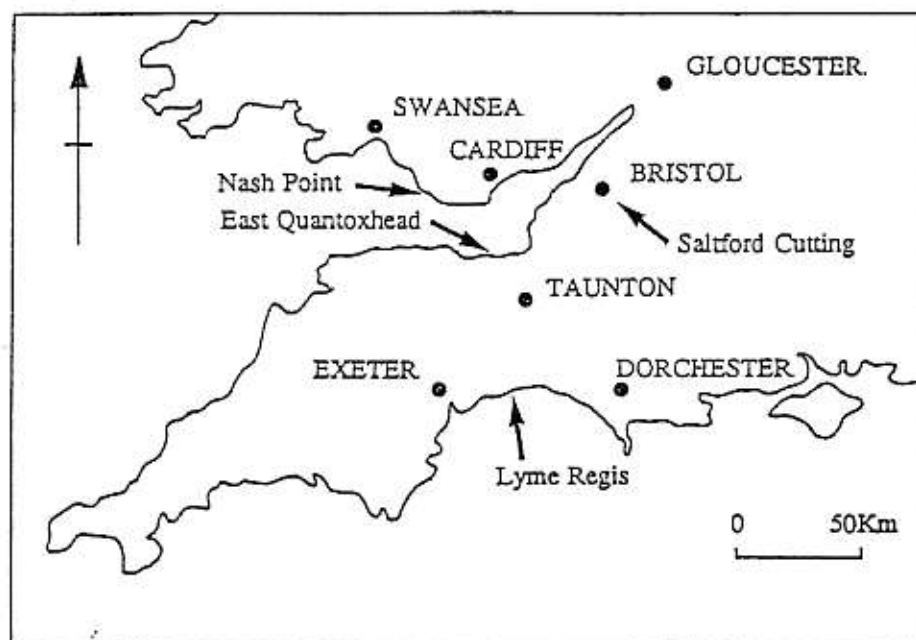


Fig. 1 - The location of the key Hettangian-Sinemurian boundary localities in south west Britain.

across the stage boundary. Implications for the selection of a Sinemurian Global Stratotype Section and Point (GSSP) are discussed.

Introduction

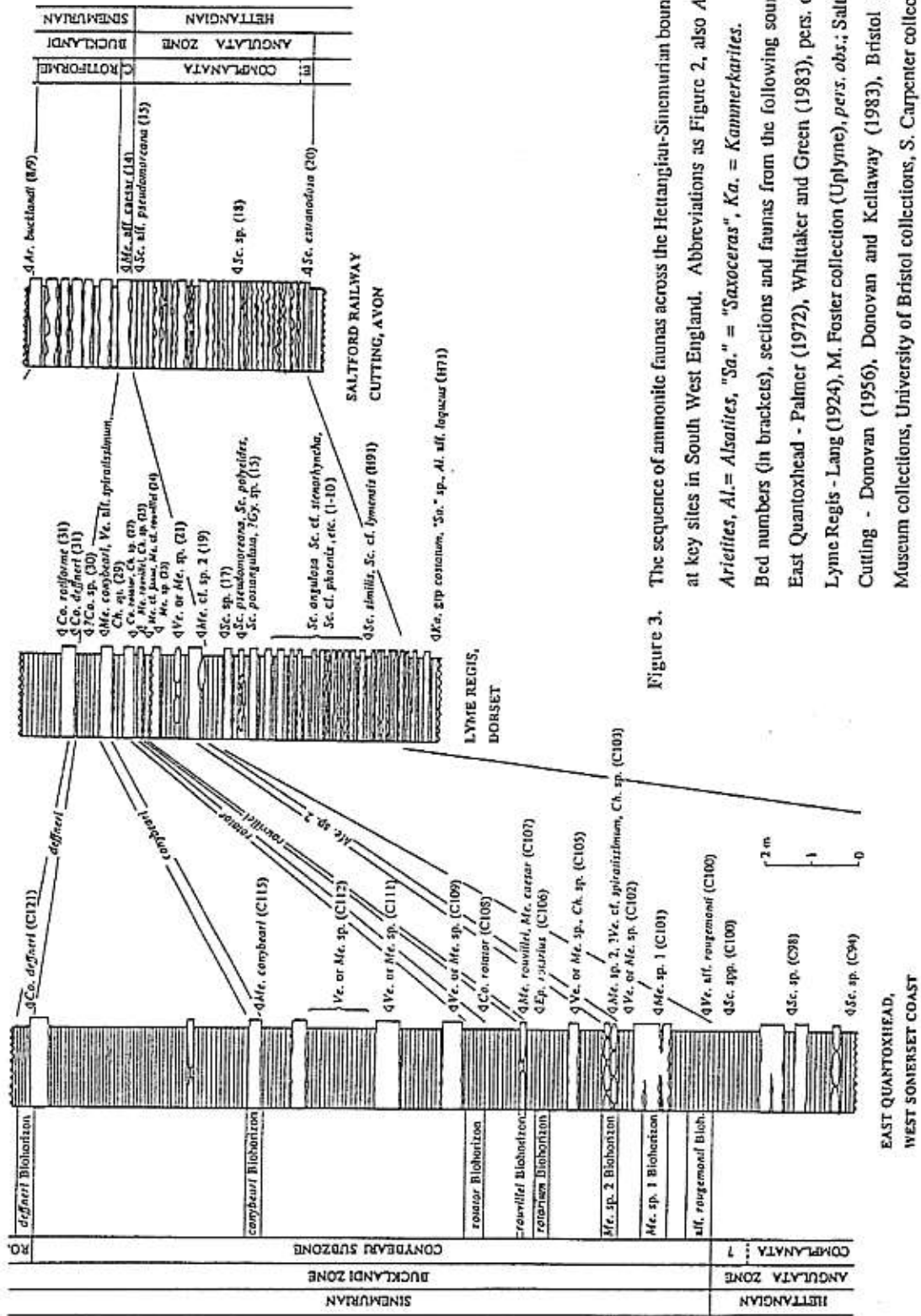
South western Britain, especially the counties of Dorset and Somerset (*sensu lato*, including Avon) have long been famous for exposures of Hettangian and Lower Sinemurian rocks and especially for their ammonite fauna (Fig. 1, LANG, 1924 ; SPATH, 1924 ; PALMER 1972a, b, 1976 ; WHITTAKER & GREEN, 1983 ; DONOVAN & IVIMEY-COOK, 1983 ; DONOVAN 1952a, b, 1956, DONOVAN & KELLAWAY 1984). The sections around Lyme Regis in Dorset, in particular, have been previously considered to include a reference section or "stratotype" for the base of the Sinemurian Stage (DONOVAN *in* MORTON, 1971 ; TAYLOR, 1986 ; COX, 1990). This usage does not, however, have an officially approved status (i.e. by the International Commission on Stratigraphy (ICS). A Global Stratotype Section and Point (GSSP) therefore remains to be selected and confirmed.

A recent excursion (April 1994) in conjunction with Dr. G. BLOOS (SMNS, Stuttgart) under auspices of the Sinemurian Working Group of the ISJS has led to a reassessment of sections and faunas across the Hettangian-Sinemurian boundary at this locality and others within neighbouring counties in South west Britain. This has facilitated a revision of the correlatively-important ammonite faunas, which are here characterised as a sequence of biohorizons (or "faunal horizons" *sensu* CALLOMON, 1985 ; PAGE, 1992 ; DOMMERMUES, PAGE & MEISTER, 1994) or "assemblages" when less well characterised, and correlated with the Standard Zonation for the terminal Hettangian and basal Sinemurian (as described by DONOVAN *in* DEAN *et al.* 1961 and later modified by BLOOS 1983, 1985) [Figure 2].

Hettangian biohorizons or assemblages are not here consecutively numbered, pending a fuller revision of ammonoid sequences within the stage. Sinemurian biohorizons are numbered as per PAGE (1992) with additional units added by suffixes (e.g. 2a and 2b) ; this should not, however, be taken to indicate a subdivision of the original numbered biohorizon, it is in fact an addition of a new division, but with a retention of the integrity of the original numeric sequencing of the faunas.

SINEMURIAN	Bucklandi Zone Conybeari Subzone	Rotif.	<i>deffneri</i> Biohorizon (6): <i>Co. deffneri</i> (Oppel)		
			<i>conybeari</i> Biohorizon (5): <i>Me. conybeari</i> (J. Sowerby), <i>Ve. aff. spiratissimum</i> (Quenstedt), <i>Ch. sp.</i>		
			<i>rotator</i> Biohorizon (4): <i>Co. rotator</i> (Reynès), <i>Ch. sp.</i>		
			* <i>rouvillei</i> Biohorizon (3b): <i>Me. rouvillei</i> (Reynès), <i>Me. caesar</i> (Reynès), <i>Ch. sp.</i> (giant) [Reference: Bed C 107 of Palmer 1972, West Somerset Coast]		
			* <i>rotarius</i> Biohorizon (3a): <i>Ep. rotarius</i> . (Buckman) [Reference: Bed C106 of Palmer 1972, West Somerset Coast]		
			* <i>Me. sp. 2</i> Biohorizon (2b): <i>Me. sp. 2</i> (large form comparable to paratype of " <i>Co.</i> " <i>laugierii</i> Guérin-Franiatte 1965, pl.37 only), ? <i>Ve. cf. spiratissimum</i> (Quenstedt), <i>Ch. sp.</i> [Reference: Bed C103 of Palmer 1972, West Somerset Coast]		
			* <i>Me. sp. 1</i> Biohorizon (2a): <i>Me. sp. 1</i> (large forms with close ribbed inner whorls) [Reference: Bed C101 of Palmer 1972, West Somerset Coast]		
			<i>aff. rougemonti</i> (Reynès) Biohorizon (1): <i>Ve. aff. rougemonti</i> (Reynès) (= <i>solarioides</i> sensu Ivimey-Cook and Donovan <i>non</i> Da Costa).		
		HETTANGIAN	Angulata Zone Complanata Subzone	7 Depresa	<i>Sc. sp.</i>
					* <i>pseudomoreana</i> Biohorizon: <i>Sc. pseudomoreana</i> Spath, <i>Sc. polyoides</i> Lange, <i>Sc. postangulata</i> Lange, ? <i>Gy. sp.</i> [Reference: Beds 14-15 of Lange 1924, Lyme Regis, Dorset]
	<i>Sc. angulosa</i> Lange, <i>Sc. cf. stenorhyncha</i> Lange, etc.				
	* <i>similis</i> Biohorizon: <i>Sc. similis</i> Spath, <i>Sc. cf. lymensis</i> Spath. [Reference: Bed H91 of Lang 1924, Lyme Regis, Dorset]				
Extra.	* <i>extranodosa</i> Biohorizon: <i>Sc. extranodosa</i> (Wachner) [Reference: Bed 20 of Donovan 1956, Saltford Cutting, near Bristol, Avon = Somerset <i>sensu lato</i>].				

Fig. 2 - The sequence of ammonite biohorizons and assemblages across the Hettangian-Sinemurian boundary in South West England. Asterisks (*) indicate newly recognised biohorizons. Abbreviations as follows : *Sc.* = *Schlotheimia*, *Gy.* = *Gyrophioceras*, *Ve.* = *Vermiceras*, *Me.* = *Metophioceras*, *Ch.* = *Charmasseiceras*, *C.* = *Sulciferites (sensu lato)*, *Co.* = *Coroniceras*, *Ep.* = *Epammonites*.



Discussion

Not all faunas identified on Figure 2 can currently be recognised *in situ* at any one locality but it is readily apparent that by far the most complete earliest Sinemurian ammonite sequence in the region (and probably in Britain as a whole) is on the Somerset coast, near the village of East Quantoxhead (Figure 1 ; National map grid references ST 137 443). The Hettangian faunas of this locality are less well characterised but crushed schlotheimiid ammonoids do occur and may ultimately be correlatable with better preserved faunas at other localities. The county of Somerset in which the site lies is also historically important as the source of the type specimens of the indexes of the first two subzones of the Bucklandi Zone, and indeed of the zone itself (*Metophioceras conybeari* (SOWERBY, 1816) ; *Coroniceras rotiforme* (SOWERBY, 1924) and *Arietites bucklandi*, (SOWERBY, 1816) ; DONOVAN *in* DEAN *et al.*, 1961).

Exposed sequences elsewhere in Britain, including coastal sections on the coasts of Dorset (Lyme Regis ; LANG, 1924 ; SPATH, 1924 ; PAGE, 1992 ; Figure 3), Glamorgan (Nash Point, South Wales ; TRUEMAN, 1922, 1930 ; WILSON *et al.*, 1990 ; pers. obs.), Cleveland (Redcar, North-East England ; TATE & BLAKE, 1876 ; POWELL 1986 ; pers. obs.) and the Isle of Skye, [(Western Scotland ; BUCKMAN, 1920 ; LEE, 1920 ; OATES, 1978 ; HALLAM, 1959) and inland exposures near Bristol (Saltford Railway Cutting ; DONOVAN, 1956 ; Figure 3) and Rugby (Warwickshire, English Midlands ; HALLAM, 1968 ; CLEMENTS *et al.*, 1977 (MS))] are, in comparison, often considerably thinner and with a relatively incomplete sequence probably of faunas. Similarly, the remarkable thickness of the Somerset section and its faunal completeness make it unique in Europe - elsewhere the trans-boundary succession is often demonstrably stratigraphically incomplete or in condensed facies (for instance in Southern and Northern Germany, Burgundy, Ardèche and the Jura ; BLOOS, 1983, a, b ; CORNA, 1985, 1987 ; ELMI & MOUTERDE, 1965 ; CORNA & MOUTERDE, 1988, etc.).

The Somerset locality therefore has the potential to be recognised as a GSSP and qualifies under most the guidelines recommended by the ICS (COWIE *et al.*, 1988) especially when considering the large size, completeness and thickness of exposure (in both foreshore and cliff), the correlation potential of the ammonite faunas and the conserved status of the area (the site falls within the Blue Anchor to Lilstock Coast Site of Special Scientific Interest, as protected by the British 1981 Wildlife and Countryside Act).

No systematic sampling work has been carried out, however, with correlation tools other than ammonites, and full consideration of GSSP potential may need to be deferred until micropalaeontological studies, at least, have been completed. In addition, further taxonomic study of the ammonites is needed to fully characterise each successive species. Nevertheless, preservation is often relatively good, and these faunas therefore have a high potential for use in the international correlation of the base of the Sinemurian stage.

Acknowledgements

Dr. G. BLOOS (SMNS, Stuttgart) for discussion and assistance in determining faunas. Peter CROWTHER and Roger CLARK (Bristol City Museum), Liz LOEFFLER (University of Bristol), Denis PARSONS (County Museum, Taunton) and Peter HODGES (National Museum of Wales, Cardiff) for assistance and access to collections in their care. Peter HODGES and Hugh PRUDDEN (Montacute, Somerset) for assistance in the field.

References

- BUCKMAN, S.S. (1920) : Appendix 1 : Palaeontological classification and comparison of certain Jurassic rocks of Rasay and Skye. *In* : LEE, G.W. : 64-89.

- BLOOS, G. (1983) : The zone of *Schlotheimia marmorea* (Lower Lias) - Hettangian or Sinemurian? *Newsl. Stratig.*, 12 : 123-131.
- BLOOS, G. (1985) : On Lower Lias ammonite stratigraphy - present state and possibilities of revision. In : MICHELSEN, O. and ZEISS, A. (eds). *International Symposium on Jurassic Stratigraphy*, Erlangen, 1984, I : 146-157.
- BLOOS, G. (1985) : Les couches basales du Sinémurien - Une révision stratigraphique. *Cahiers Inst. Cath. Lyon*, 14 : 59-68.
- CALLOMON, J.H. (1985) : Biostratigraphy, chronostratigraphy and all that - again ! *Proc. Int. Symp. Jur. Stratig. Erlangen 1984*, III : 611-624.
- CLEMENTS, R.G., ASHBY, L., BACON, M.C., CARTWRIGHT, G.E., CHISHOLM, W. HARRIS, K., MASEY, D., Mc SHANE, I.E., MILLER, D.W., WYATT, M.G. (1977) : *Report on the Geology of Parkfield Road Quarry, Rugby*. Unpubl. MS, Department of Geology, University of Leicester.
- CORNA, M. (1985) : Le Lias du Jura méridional, paléontologie biostratigraphique du Sinémurien : approche paléoécologique. *Thèse 3^e cycle, Univ. Claude-Bernard Lyon*, 1647 (unpubl.).
- CORNA, M. (1987) : Les horizons sinémuriens du Calcaire à Gryphées du Jura méridional français (Zone à Conybeari-Zone à Obtusum). *Geobios*, 20 : 531-536.
- CORNA, M. & MOUTERDE, R. (1988) : Le Sinémurien de Semur (France) : essai de biozonation pour le Sinémurien inférieur et le Lotharingien inférieur du stratotype et du Jura méridional. In : *Proc. 2nd Int. Symp. Jur. Stratig. Lisboa, 1987. Inst. Nat. Investig. Cient, Lisboa* : 101-107.
- COX, B.M. (1990) : A review of Jurassic chronostratigraphy and age indicators for the U.K. In HARDMAN, R.F.P. & BROOKS, J. (eds). *Tectonic events responsible for Britains oil and gas reserves. Geological Society of London, Special Publication*, 55 : 169-190.
- DEAN, W.T., DONOVAN, D.T. & HOWARTH, M.K. (1961) : The liassic ammonite zones and subzones of the North - West European Province. *Bull. Br. Mus. Nat. Hist. Ser. Geol.*, 4 : 435-505.
- DOMMERMUES, J.L., PAGE, K.N. & MEISTER, C. (1994) : A detailed correlation of Upper Sinemurian (Lower Jurassic) Ammonite Biohorizons between Burgundy (France) and Britain. *Newsl. Stratig.*, 30 : 1-13.
- DONOVAN, D.T. (1952a) : The Ammonites of the Blue Lias of the Bristol district. I. Psiloceratidae. *Ann. Mag. Nat. Hist. Lond.*, 5 : 629-655.
- DONOVAN, D.T. (1952b) : The Ammonites of the Blue Lias of the Bristol district. II. Arietitidae. *Ann. Mag. Nat. Hist. Lond.*, 5 : 717-752.
- DONOVAN, D.T. (1956) : The Zonal Stratigraphy of the Blue Lias around Keynsham, Somerset. *Proc. Geol. Assoc. Lond.*, 66 : 182-212.
- DONOVAN, D.T. & KELLAWAY, G. (1984) : Geology of the Bristol district : the Lower Jurassic rocks. *Mem. Geol. Surv. G.B.* : 69 pp.

- ELMI, S. & MOUTERDE, R. (1965) : Le Lias inférieur et moyen entre Aubenas et Privas (Ardèche). *Trav. Lab. Géol. Fac. Sci. Lyon.*, n. sér. 12 :
- GETTY, T.A. (1980) : Hettangian-Sinemurian, *In* : COPE, J.C.W., GETTY, T.A., HOWARTH, M.K., MORTON, N. & TORRENS, H.S. A correlation of Jurassic rocks in the British Isles. Part One. *Spec. Rept. Geol. Soc. Lond.*, 14 : 33-47.
- GUÉRIN-FRANIATTE, S. (1986) - : Ammonites du Lias inférieur de France ; Psilocerataceae : Arietitidae, Paris-, 455 pp (2 vol.).
- HALLAM, A. (1959) : Stratigraphy of the Broadford Beds of Skye, Raasay and Applecross. *Proc. Yorks. Geol. Soc.*, 32 : 165-189.
- HALLAM, A. (1968) : The Lias. *In* : SYLVESTER-BRADLEY, P.D. & FORD, T.D. The Geology of the East Midlands. *Leicester University Press* : 188-210.
- IVIMEY-COOK, H.C. & DONOVAN, D.T. (1983) : Appendix 3 : The fauna of the Lower Jurassic *In* : WHITTAKER, A. & GREEN, G.W. : 126-130.
- LANG, W.D. (1924) : The Blue Lias of the Devon and Dorset coasts, *Proc. Geol. Assoc. Lond.*, 35 : 169-185.
- LEE, G.W. (1920) : The Mesozoic rocks of Applecross, Raasay and north-east Skye. *Mem. Geol. Surv. G.B., Scotland*, 147 pp.
- MORTON, N. (1971) : The definition of standard Jurassic Stages. *Mém. B.R.G.M., France*, 75 : 83-93.
- OATES, M.J. (1978) : A revised stratigraphy for the western Scottish Lower Lias. *Proc. Yorks. Geol. Soc.*, 42 : 143-156.
- PAGE, K.N. (1992) : The sequence of ammonite correlated horizons in the British Sinemurian (Lower Jurassic). *Newsl. Stratig.*, 27 : 129-156.
- PALMER, C.P. (1972a) : The Lower Lias (Lower Jurassic) between Watchet and Lilstock in north Somerset (United Kingdom). *Newsl. Stratig.*, 2 : 1-30.
- PALMER, C.P. (1972b) : A revision of the zonal classification of the Lower Lias of the Dorset coast of south west England. *Newsl. Stratig.*, 2 : 45-54.
- POWELL, J.H. (1986) : Lithostratigraphical nomenclature of the Lias Group in the Yorkshire Basin. *Proc. Yorks. Geol. Soc.*, 45 : 51-57.
- SPATH, L.F. (1924) : The Ammonites of the Blue Lias. *Proc. Geol. Assoc. Lond.*, 35 : 186-208.
- TATE, R. & BLAKE J.F. (1976) : The Yorkshire Lias. J. VAN VOORT, London 475 pp.
- TAYLOR, D.G. (1986) : The Hettangian-Sinemurian Boundary (Early Jurassic) : reply to Bloos 1983. *Newsl. Stratig.*, 16 : 57-67.
- TRUEMAN, A.E. (1922) : The Liassic rocks of Glamorgan. *Proc. Geol. Assoc. Lond.*, 33 : 245-284.
- TRUEMAN, A.E. (1930) : The Lower Lias (Bucklandi Zone) of Nash Point, Glamorgan. *Proc. Geol. Assoc. Lond.*, 41 : 148-159.

WHITTAKER, A. & GREEN, G.W. (1983) : Geology of the country around Weston-super-Mare. *Mem. Geol. Surv. G.B.*, 147 pp.

WILSON, D., DAVIES, J.R., FLETCHER, C.J.N. & SMITH, M. (1990) : Geology of the South Wales Coalfield, Part VI, the country around Bridgend (2nd edition). *Mem. Brit. Geol. Surv.* HMSO.

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TOARCIAN WORKING GROUP (TWG)

by S. ELMI, Convenor

The planning of the meetings has been very tight during the last three years. Since the Poitiers Symposium, the Skye and Marrakech meetings of the Aalenian and Bajocian working groups have given an opportunity to debate on the lower boundary of the Aalenian and on the biostratigraphy of the uppermost levels of the Toarcian.

No formal meeting of the Toarcian WG has been held. However, several discussion and exchanges have occurred especially during the finalization of the publication of the french WG (Groupe français d'Étude du Jurassique, GFEJ). In this scope, two successive scales have been established owing to the important progress made during the last five years in the levelling of many key-species (*Pleydellia aalensis*, *Pleydellia celtica*, *P. subcompta*, the possible misinterpretation of "*P. fluitans*", *Leioceras opalinum* and several Hammatocera-tids) as in the paleontological domain (important papers by HOWARTH, OHMERT, GOY etc.).

However, as the second work seems to be published before the first (the long delayed Poitiers Symposium), the resulting situation is a little bit disappointing as the first version is now somewhat obsolete but it gives a large view of the Tethyan problems.

It must be also stressed that, during the Marrakech meeting, several specialists have had the opportunity to visit a very important Toarcian profile (Taksempt on the northern side of the High Atlas) studied by SADKI after preliminary researches by MOUTERDE and DUBAR. It seems to be of tremendous interest for the definition of the Pliensbachian-Toarcian boundary.

An informal meeting has been planned for the 18th or the 25th of September in Madrid in order to define some points of general interest. But owing to tight plannings, it seems to be deleted.

Concerning the Pliensbachian-Toarcian boundary, some considerations can be already made.

1 - In the Meso-european areas

1a - In the areas studied by GABILLY, the Jard profile gives a good source of information. It is also well situated along an easily accessible beach and the outcrops are frequently

renewed. However, the Domerian-Toarcian limit seems to be only incompletely recorded. Field work is needed.

1b - The Yorkshire profiles has been recently revised in the Howarth's synthetic paper. They give an indispensable reference on the historical point of view. A field meeting would be of interest. The scope of the gaps must be checked and faunal peculiarism can complicate the correlations.

1c - The classic outcrops of the Lyon area (Mont d'Or, La Verpillière, Beaujolais) evidence gaps at the lower boundary. Some "lags" can we found but these profiles are not convenient to design a "golden spike" despite the rich and beautifully preserved ammonite-fauna. The same objection seems can be made to the Causses (Aveyron) and to the Quercy.

1d - The South german profiles (Württemberg, Wutach...) seem to be very useful and a field meeting appears to be necessary.

1e - In Spain, the Iberic profiles studied by the Goy's group give good successions of apparently continuous series. They are very important because they evidence the association of "northern" (meso-european) and "southern" (tethyan) ammonites. Their disadvantages are in the poor preservation of many specimens. A field meeting appears nevertheless useful.

2 - In the Tethyan areas, there is a plenty of opportunities

2a - The classic italian profiles (Apennines, Sicily) have the disadvantage to be condensed. The "Mirabile beds" are often bound by erosional limits.

2b - The Portugal can give a good reference profile at Peniche a locality visited during the 1987 Symposium and well known by the MOUTERDE's and ROCHA's works.

2c - In the Maghreb, the Taksemt profile seems to me to be one of the best known, at least for the Tethyan realm and, probably, for the whole European - Tethyan areas.

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THE JOINT MEETING OF THE AALENIAN (AWG AND BAJOCIAN (BWG) WORKING GROUPS

Marrakech, Morocco, 25-31 May 1994

S. CRESTA & G. PAVIA, convenors

Introduction

The third meeting of the Bajocian Working Group of the ISJS was programmed as a joint reunion with the Aalenian Working Group. The meeting has been organized by D. SADKI and his colleagues of the Marrakech and Rabat Universities, which introduced participants in the geology and stratigraphy of the Moyen and the Haut Atlas.

More than forty workers attended the meeting. Most of them came from Northern Africa (Algeria and Tunisia but mainly Morocco). From outside, the following countries were represented ; Canada (1), France (5), Germany (1), Great Britain (2), Hungary (1), Italy (2), Portugal (2), Spain (6), Sweden (2). The meeting started at Marrakech on Wednesday 25th May with oral presentations and working-group sessions. From Friday 27th to Tuesday 31st May the field trip developed on the stratigraphy of the Moyen and the Haut Atlas.

The Proceedings of the meeting are to be printed by the Servizio Geologico d'Italia (CRESTA & PAVIA eds.) and distributed during the ISJS Symposium of Argentina, October 1994. In the volume programme, field trip descriptions and communications will be assembled.

Oral Presentations

Prof. J.P. SCHAEER offered an introductory lecture on the sedimentary and structural evolution of the Haut-Atlas. Twenty-four contributions were then presented during the scientific sessions at Marrakech. They were divided in four topics :

- a) Aalenian and Bajocian stratotypes.
- b) Aalenian and Bajocian ammonite biostratigraphy.
- c) Other biostratigraphic methods.
- d) Aalenian and Bajocian events.

Aalenian Working Group session

- 1) A. Goy (Madrid, Spain) was returning the commission he received in Lisboa (1987). With an unanimous vote S. CRESTA (Roma, Italy) has been selected as the new coordinator of the Aalenian Working Group. His nomination will be ratified by the ISJS in Argentina. For pushing on the problems concerning the Working Group (see point 2 below), the coordinator was thinking to organize a meeting as soon as possible, maybe in 1995 in Germany or in Spain.
- 2) The session concentrated both on the best faunal horizon, ammonite association or species which can be used for marking the beginning of the Aalenian Stage and on proposals for the selection of the lower boundary stratotype. As far as the second point was concerned, two sections have been discussed, both presented during the past meeting at Portree, Isle of Skye (1991) and examined again at Marrakech with more detailed information :
 - a) Wittnau in the Oberrhein area (SW Germany) studied by W. OHMERT and already presented in Skye conference (1991) as the possible GSSP of the Aalenian. At present there is good resolution concerning ammonite, foram and ostracod biostratigraphy ; new data have been furnished by geochemical analyses (M. MARTIN) and preliminary magnetostratigraphic studies were done and can be improved if the Working Group will present a formal application to the German Geological Survey.
 - b) Fuentelsaz in the Iberian range (Spain) studied by A. Goy and collaborators. There is a good resolution concerning ammonites, forams, brachiopods and ostracods. New data on the calcareous nannofossil content have been presented at Marrakech. At present, no information on magnetostratigraphy.

Bajocian Working Group session

- 1) G. PAVIA (Torino, Italy), after ten years of activity, was returning the commission as the coordinator of the BWG. With an unanimous vote A. GALACZ (Budapest, Hungary) has been selected as the new coordinator of the Bajocian Working Group. His nomination will be ratified by the ISJS in Argentina.
- 2) Apart from the selection of the boundary stratotype (see point 3 below), open problems of the Bajocian biochronology and chronostratigraphy have been summarized. In particular

the past coordinator focused on the necessity to define : subzonal scheme of the lowermost Bajocian (i.e. the Discites Zone) ; the meaning and the rank of the Ovalis unit (Subzone or Zone ?) ; the substitution of the Subfurcatum name (derived from an ammonite of the Garantiana Zone !) by the Niortense one for the first biostratigraphic zone of the Upper Bajocian, as already stated by DIETL in 1981. In general it has been recommended to pursue and complete the collecting of reviews of the Bajocian zonal and subzonal units for trying to make an up-to-date revision of the standard chronostratigraphic scale and to define stratotypes for each zonal unit as well.

- 3) The session actually concentrated on the proposals for the selection of the lower boundary stratotype of the Bajocian Stage. Two communications were presented by HENRIQUEZ *et al.* [La limite Aalénien-Bajocien au Cap Mondego (Portugal)] and by MORTON (Stratigraphical markers in the Aalenian-Bajocian boundary succession at Bearreraig, Isle of Skye, Scotland). Both actually constituted the check and deepening of stratigraphic data collected from those sections and two-times already discussed, namely in the past Bajocian meetings at Piobbico (1988) and Portree, Skye (1991). We discussed for possibly stating which section (Cap Mondego or Bearreraig) could be the best for proposing as the Bajocian GSSP to the ISJS and then to the ICS. Two aspects were evident : (1) information furnished by English and Portuguese colleagues was the best we could presently obtain ; (2) there were no possibilities to reach any agreement on a single proposal and nobody was pushing for a ballot. This dilemma was already lived through in the Portree conference ; in that occasion no resolutions were passed as both sections did not completely satisfy criteria recommended by ICS guide-lines. The Marrakech meeting brought back the dilemma to : (a) the Bearreraig section is the best one for documenting the evolutionary lineage of the ammonite genus *Hyperlioceras* which we confirmed the Bajocian lower boundary has to be fixed on ; (b) the Cap Mondego section is the most suitable one for direct correlation based on ammonite associations.

On the other hand, no-way to discuss on other alternatives as no further proposals have been presented. In fact, D. SADKI summarized the biostratigraphy but did not presented any other stratigraphic information (microfossils, chemo- and magnetostratigraphy, etc.) for the Kerrando-Bourrama section (Haut-Atlas) he already proposed in the last ISJS at Poitiers (1991) as the auxiliary stratotype of the Bajocian lower boundary. Unfortunately SADKI's paper has been not yet published ; nevertheless we directly verified on the field, during the excursions, that the section could be very useful for worldwide correlations by the rich ammonite associations at the Aalenian-Bajocian boundary.

Owing to this impasse, a mail voting on this subject has been organized. The vote is involving both people currently working on the Bajocian stratigraphy and the coordinators of the working groups of the ISJS for the choice between Bearreraig and Cap Mondego sections. The ballot contains the possibility of absention too ; by this choice voters judge that neither the Bearreraig section nor the Cap Mondego one are satisfactory for the Bajocian GSSP, but a different section must be proposed and/or (why not ?) the validity of the basal boundary index (the ammonite genus *Hyperlioceras*) as correlation tool is to be discussed. Returns of the vote will be presented in the Bajocian report for the ISJS Symposium of Argentina, October 1994.

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**PROPOSAL FOR THE GLOBAL STRATOTYPE SECTION AND POINT (GSSP)
OF THE AALENIAN/BAJOCIAN BOUNDARY : CALL FOR OPINIONS.**

The meeting of the Aalenian and Bajocian Working Groups of the ISJS were held in Marrakech (Morocco) from 25th to 31st May 1994. Two days have been devoted for scientific

sessions on several topics, the main of which concerned the Aalenian and Bajocian boundary stratotypes. In the second part of the meeting (five-day excursion) Moroccan colleagues introduced us in the geology and stratigraphy of the Moyen and the Haut Atlas. In particular we visited the Kerrando-Gourrama section proposed by SADKI in the last ISJS Symposium at Poitiers (1991) as the auxiliary stratotype of the Bajocian lower boundary. Unfortunately SADKI's paper has been not yet published but, on the basis of the summary presented in the excursion guide-book and of direct observations on the field, this section seems to be very useful for worldwide correlations by the very rich and diversified ammonite associations at the Aalenian-Bajocian boundary, which can be fixed by a typical *Graphoceras-Hyperlioceras* association.

The Proceedings of that meeting are to be printed by the Servizio Geologico d'Italia (CRESTA & PAVIA eds) and distributed during the ISJS Symposium of Argentina, October 1994. In the Proceedings you will find programme, excursion descriptions and detailed reports of the Aalenian-Bajocian joint meeting.

As far as the Bajocian GSSP was concerned, two communications were done by Henriquez *et al.* (La limite Aalénien-Bajocien au Cap Mondego (Portugal) and by MORRIS (Stratigraphical markers in the Aalenian-Bajocian boundary succession at Bearreraig, Isle of Skye, Scotland). Both actually constituted the check and deepening of stratigraphic data collected from those sections and two-times already discussed, namely in the past Bajocian meetings at Piobbico (1988) and Portree, Skye (1991) [see respective Proceedings]. Closing the sessions, we discussed for possibly stating which section (Cap Mondego or Bearreraig) could be the best for proposing as the Bajocian GSSP to the ISJS and then to the ICS. Two aspects were evident: (1) information furnished by English and Portuguese colleagues was the best we could presently obtain; (2) there were no possibilities to reach any agreement for a single proposal and nobody was pushing for a ballot. This dilemma has been already lived through in the Portree meeting; in that occasion no resolutions were passed as both sections did not completely satisfy criteria recommended by ICS guide-lines. The Marrakech meeting brought back the dilemma to: (a) the Bearreraig section is the best one for documenting the evolutionary lineage of the ammonite genus *Hyperlioceras* which we confirmed the Bajocian lower boundary has to be fixed on; (b) the Cap Mondego section is the most suitable one for direct correlation based on ammonite associations. On the other hand, no-way to discuss on other alternative as any further data have been presented; in particular, for the Kerrando-Bourrama section, we had just a biostratigraphic summary but no other stratigraphic information (microfossils, chemo-magnetostratigraphy, etc).

Owing to this impasse we decided to organize a mail voting on this subject. The vote is involving both people currently working on the Bajocian stratigraphy and the coordinators of other working groups of the ISJS (more than 70 persons) for the choice between Bearreraig and Cap Mondego sections. In this selection, they can refer to the reports here attached, which summarize the up-to-date knowledge on these sections.

The ballot contains the possibility of abstention too. By this choice voters judge that neither the Bearreraig section nor the Cap Mondego one are satisfactory for the Bajocian GSSP, but a different section must be examined and proposed. It is worth noting however that such a conclusion automatically means the abandonment of the work already done, a long-way revision (e.g. Kerrando-Bourrama section) or/and, maybe, a new selection of the basal boundary index, i.e. ammonite species of different genus than *Hyperlioceras*.

Please, fill in the attached schedule and return it as soon as possible, in any case no later than 5th October 1994 so that I will be in time for ordering and presenting returns in the Bajocian report for the ISJS Symposium of Argentina.

In the Marrakech meeting a new coordinator of the Bajocian Working Group has been selected: Dr. Andras GALACZ from Budapest, Hungary. His nomination will be ratified by the

**INTERNATIONAL SUBCOMMISSION ON JURASSIC STRATIGRAPHY
BAJOCIAN WORKING GROUP**

*VOTE
ON THE PROPOSAL FOR THE BAJOCIAN GSSP*

Please mark the appropriate box below and return this ballot to the coordinator of the B.W.G not later than 5th October 1994:

GIULIO PAVIA
Dipartimento di Scienze Terra
via Accademia Scienze 5
I-10123 TORINO, Italy
fax: .39.11.541755

Which section do you think is the best one to be proposed as the Bajocian Global Stratotype Section and Point?

- [1] Bearreraig Bay section, Isle of Skye, Scotland
(see attached report by Morton)..... []
- [2] Cap Mondego, Portugal
(see attached report by Rocha et al.)..... []
- [3] Abstention
(a different section must be examined and proposed)..... []

Comments (if necessary, continue overleaf):
.....
.....

Signature:
Address:
.....
.....
tel. fax

BAJOCIAN LIST OF THE ISJS

Are you interested to be comprised in the list of the Bajocian Working Group?
YES..... []
NO..... []

ISJS in Argentina. A. GALACZ asked me to update the list of workers joining in the Bajocian Working Group. Adhesions have been already collected by the first circular of the Marrakech meeting but this mailing is the occasion for renewing and completing them. So, please, answer to the last question in the attached schedule ; your returns will constitute the official but open list of the Bajocian workers of the ISJS.

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SELECTION OF BAJOCIAN GSSP
Proposal for Bearreraig, Isle of Skye, Scotland

MORTON N. Birkbeck College, London

Introduction

Definition of chronostratigraphical units by selection of a specific point in a stratotype section, to define the basal boundary, is generally accepted, and the ICS has established guidelines on the criteria to be fulfilled. These include continuity of sedimentary succession, absence of structural or other complications, maximum resolution and precision in the (relative) dating and correlation of the boundary, and availability of the greatest possible range of potential methods of correlation.

In Jurassic stratigraphy ammonite biostratigraphy is recognized as pre-eminent for high-resolution correlation and is, therefore, the starting point for discussion. For the Bajocian Stage the Discites Zone has been accepted internationally as the basal zone of the stage since the 1962 and 1967 Luxembourg colloquia. In subsequent meetings (Erlangen 1984, Lisboa 1987, Piobbico 1988, Portree 1991, Poitiers 1991) the evolution of the ammonite family Graphoceratidae has been recognized as providing the highest biostratigraphical resolution and most precise correlation in particular (following MOUTERDE *et al.*, 1972), the first appearance of species of the genus *Hyperlioceras* (including *Toxolioceras*) was accepted by general consensus as being the biostratigraphical event which best enables recognition of the basal boundary of the Bajocian Stage.

This event can be recognised in a palaeobiogeographic province which extends from NW Scotland to North Africa and eastwards to at least the Caucasus. Elsewhere, supplementary criteria, with consequent reduction of chronostratigraphical resolution, must be used. These include other ammonite groups such as the Hammatoceratidae and Sonniniidae, which have lower biostratigraphical precision, and other fossil groups.

The present situation for the base of the Bajocian at Bearreraig, with respect to the most important fossil groups and other methods of correlation, is summarised below. See MORTON (1990, 1991) for details and references.

LOCALITY AND SITE DETAILS

Detailed descriptions are given elsewhere (MORTON, 1990, 1991). The base of the Bajocian Stage is drawn 1.0 m below the top of bed U9 in the Udairn Shale Member of the Bearreraig Sandstone Formation. The precise locality is the outcrop, at U.K. National Grid reference NG 51705271, beside the pipeline cutting near the hydro-electric generating station. This is a permanent natural outcrop which has recently been enlarged, naturally and by limited excavation. The Bearreraig localities are legally protected as a Site of Special Scientific Interest (SSSI).

AMMONITE BIOSTRATIGRAPHY - GRAPHOCERATIDAE

Within the Graphoceratidae the genus *Hyperlioceras* (incl. *Toxolioceras*) evolved from *Graphoceras*, more precisely from the *Graphoceras limitatum* group (including *decorum*, *formosum*, *limitatum*). The main morphological changes include broadening and flattening of the venter, with the keel becoming more prominent. These changes can be readily established with reasonably preserved macroconchs, but are more difficult to distinguish in the corresponding microconchs.

The most complete documentation of the evolutionary lineage available is at Bearerraig, Isle of Skye, and key populations are illustrated on four plates in MORTON (1990). Successive dimorphic populations, mainly preserved in nodules, show that individual extreme variants of *Graphoceras* in the highest Concavum Zone begin to show transitional features. Similarly, variants of the earliest *Hyperlioceras* population (*H. incisum* - *M. rotabilis* m) may have more fastigate venters like the ancestral *Graphoceras*. In the lower part of the Discites Zone there is then rapid evolution with transitional populations from *H. incisum* through *H. mundum* to *H. walkeri* and *H. liodiscites*. In the lower part of the Discites Zone *Graphoceras* continues (*limitatum* group indistinguishable from those of the Concavum Zone), co-existing with *Hyperlioceras*. Details of the sequence at Bearerraig are shown in Fig. 1.

The evolutionary lineage established at Bearerraig can be confirmed in other areas. These include Dorset/Somerset (where the succession is condensed and fragmentary at any one locality), the Barranco de Agua Larga section in southern Spain (where the ammonites are mainly crushed) and the Kerrando-Gourrama section near Rich in the High Atlas, Morocco (where the earliest *Hyperlioceras* is rare). However, none of these localities provides such complete documentation of the evolutionary lineage as that seen at Bearerraig.

By comparison with these localities, there are questions and uncertainties about the succession of Graphoceratidae at Cap Mondego in Portugal. Here *Graphoceras* (at least macroconchs) disappear before the earliest *Hyperlioceras*, and the succession of *Hyperlioceras* species seen over 10 m of strata at Bearerraig is concentrated into three beds in less than 0,5 m of strata.

AMMONITE BIOSTRATIGRAPHY - OTHER FAMILIES

In the Aalenian - Bajocian boundary interval at Bearerraig non-graphoceratid ammonites are rare (see Fig. 1). *Eudmetoceras amplexans* occurs in the uppermost part of the Concavum Zone and *Euaptetoceras* sp. in the lower part of the Discites Zone. *Euhoploceras* spp. do not appear until the Discites Zone, later than in, for example, Dorset/Somerset. Correlation with other palaeobiogeographic provinces, where graphoceratids do not occur, will require an intermediate auxiliary stratotype.

OTHER MACROFOSSIL GROUPS

Belemnites are common throughout the succession and *Megateuthis quinquesulcatus* is characteristic of the upper part of the Concavum Zone (top Aalenian). However, the biostratigraphic potential of Aalenian and Bajocian belemnites has not yet been established.

Bivalves are mostly long-ranging and of limited value except for the inoceramids. At Bearerraig the base of the Bajocian is precisely marked by the first appearance of *Mytiloceramus* (tentatively identified as *polyplocus*), enabling correlation with inoceramid zones in Boreal Russia and some circum-Pacific areas.

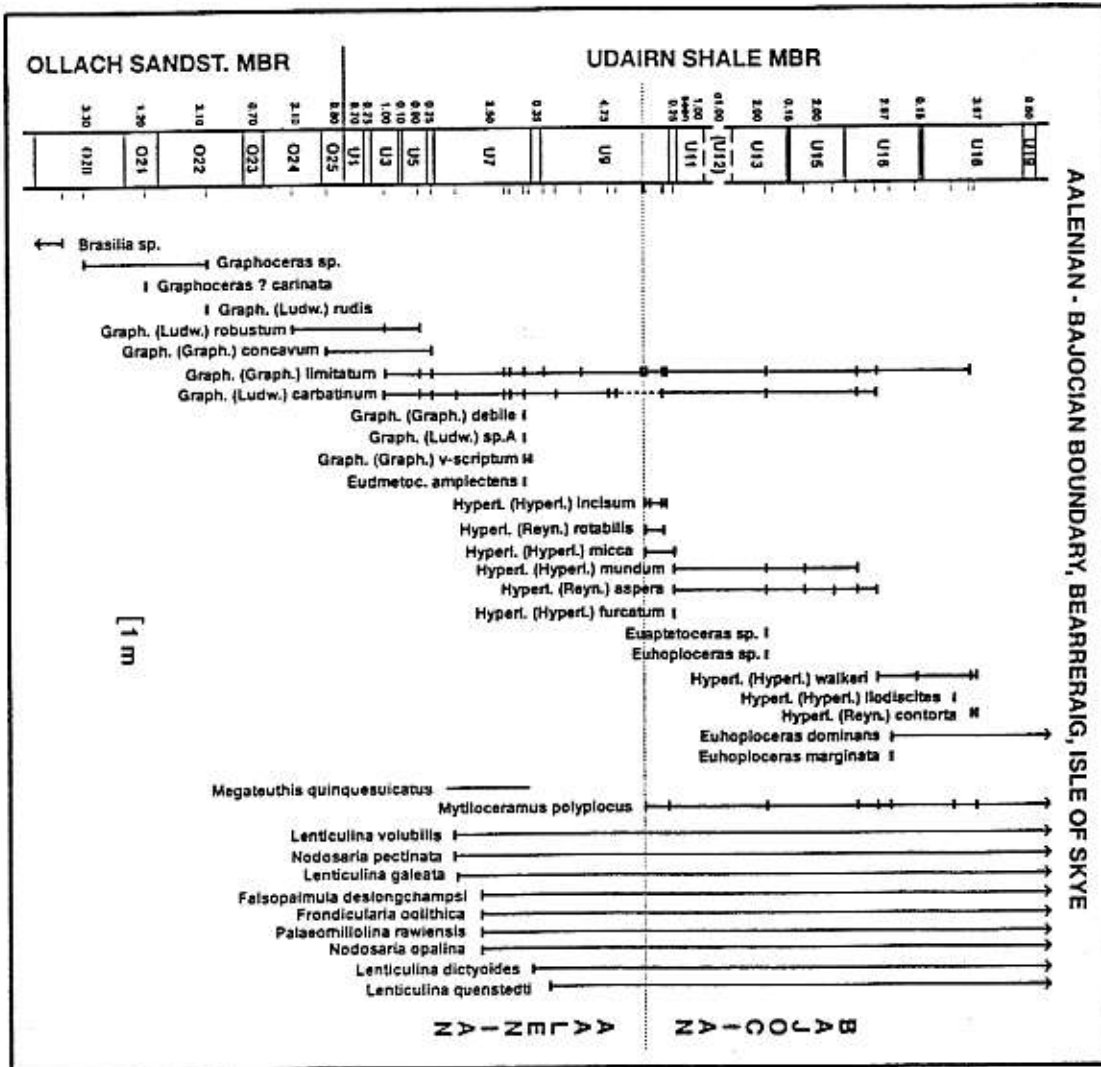


Fig. 1 - Succession across Aalenian-Bajocian boundary at Bearreraig, Isle of Skye, showing ranges of ammonites, key belemnite, bivalve and foraminiferal species.

Land plants are common as permineralised drifted fragments suggesting potential for correlation with terrestrial deposits. However, Aalenian-Bajocian species appear to be very long-ranging.

Brachiopods are too rare at Bearreraig to have correlation potential.

MICROFOSSIL GROUPS

Foraminifera were described in detail by F.J. GREGORY who identified a widely correlatable radiation event just below the base of the Bajocian. Ranges of significant marker species, such as *Lenticulina dictyoides* and *L. quenstedti*, are shown on Fig. 1.

Ostracods are present at Bearreraig but have not yet been fully investigated so that their correlation potential is unknown.

Dinoflagellates and other marine palynomorphs, investigated by J.B. RIDING, are diverse and at Bearreraig the most significant marker for the base of the Bajocian is radiation of gonyaulacacean cysts, with range bases for *Dissiliodinium erymnoteichum*, *Durotrigia daveyi* etc. in the Discites Zone and of *Pareodinia ceratophora* in the Concavum Zone. Range tops of *Moesiodinium raileanui* and *Nannoceratopsis dictyambonis* occur in the Discites Zone.

Spore/pollen florules, also investigated by J.B. RIDING, are dominated mainly by long-ranging forms, except for the distinctive *Kekryphalospora distincta* which is confined to the Discites Zone.

Calcareous nannoplankton are being investigated by P.R. BOWN, who has established that the Aalenian/Bajocian boundary at Bearreraig lies within the *Lotharingius contractus* nannofossil subzone (NJ8b).

Radiolaria are unlikely to be successfully recovered at Bearreraig because of the high proportion of detrital quartz grains.

MAGNETOSTRATIGRAPHY

E.A. HAILWOOD has confirmed the preservation of primary characteristic magnetisation in the Bearreraig section with log-mean intensities ranging from 0,124 mA/m (in Ollach Sst. Mbr.) to 0,597 mA/m (Udairn Shale Mbr.). It is therefore possible to establish a magnetostratigraphy and the Aalenian-Bajocian boundary at Bearreraig appears to lie within an interval of reversed polarity. This appears to conflict with the limited data from other sections, and it is clear that much further work is required before a reliable magnetostratigraphy can be established.

CHEMOSTRATIGRAPHY

Establishment of a Sr-isotope stratigraphy for the Jurassic is mainly at a preliminary stage at present. The potential of the belemnites at Bearreraig is being investigated, but no results are yet available.

Conclusions

- 1 - The highest resolution and greatest precision in correlation of the basal boundary of the Bajocian Stage is achieved by using the evolutionary lineage within the ammonite family Graphoceratidae, from *Graphoceras (limitatum M - carbatinum m group)* to the earliest species of *Hyperlioceras* (including *Toxolioceras (incisum M - rotabilis m)*). This was a rapid speciation event within the lineage, and is followed in the lower part of the Discites Zone by more gradual speciation with transition in macroconchs from *H. incisum* through *H. mundum* and *H. walkeri* to *H. liodiscites* and related species, and in microconchs from *H. rotabilis* to *H. aspera* then *H. contorta*.
- 2 - The most complete documentation of this evolutionary lineage in a continuous expanded sedimentary succession is at Bearreraig, Isle of Skye, NW Scotland. The sequence of species established here has been confirmed at other localities (but note reservations expressed about Cap Mondego).
- 3 - Other ammonite species, notably of *Eudmetoceras (esp. amplexens)*, *Haplopleuroceras*, *Fontannesia* and *Euhoplloceras*, have relatively longer stratigraphical ranges and therefore lower potential for precision in correlation, but must be relied on outside the palaeobiogeographic range of the Graphoceratidae. The record of non-graphoceratid ammonites at Bearreraig is inadequate and an Auxiliary Stratotype will be required.

- 4 - A wide range of other fossil groups can also be used for correlation at Bearreraig. Those of proven biostratigraphical potential include inoceramid bivalves (*Mytiloceras*), foraminifers, dinoflagellates, calcareous nannoplankton, spores and pollen. Only brachiopods are inadequately represented. Therefore Bearreraig makes available the widest range of biostratigraphical methods, including into the Boreal marine realm and into terrestrial sedimentary successions.
- 5 - The potential of the Bearreraig succession for magnetostratigraphy has been established, and that for Sr isotope stratigraphy is being investigated.

Recommendations

- 1 - The highest resolution and greatest precision in defining the base of the Bajocian Stage will be achieved by using the first appearance of species of *Hyperlioceras* (*incisum* M - *rotabilis* m) in the succession at Bearreraig, Isle of Skye. This locality should, therefore, be nominated as Global Stratotype Section and Point (GSSP).
- 2 - No single section gives complete documentation of all methods of correlation, and an Auxiliary Stratotype Section and Point, such as Rich (High Atlas, Morocco) should be selected to enable secondary correlation using non-graphoceratid ammonites and brachiopods.

References

Only key references for Bearreraig are listed here ; see either for others.

MORTON, N. 1990 : Bearreraig (Isle of Skye, NW Scotland) as boundary stratotype for the base of the Bajocian Stage. *Memorie descrittive della Carta Geologica d'Italia*, 40, 23-48, pls. 1-4.

MORTON, N. (ed.) 1991 : Proceedings of Conference of Aalenian and Bajocian Stratigraphy, Isle of Skye, Scotland, 13-20 April 1990. Birkbeck College, University of London. 129 pp, 10 pls.

AALENIAN-BAJOCIAN BOUNDARY STRATOTYPE

The Cabo Mondego section (Portugal)

1 - Motivation for the choice

The Aalenian-Bajocian boundary in the Cabo Mondego section has been considered an important reference in several discussions for the establishment of the boundary stratotype (RIEBER, 1984 ; PAVIA, 1988 ; ERBA *et al.*, 1990 ; PAVIA, 1991). The relevance of this section was firstly pointed out by R. MOUTERDE *et al.* (1972) and all the subsequent works strongly emphasise its importance for correlation with other provinces (SADKI, 1984 ; FERNANDEZ-LOPEZ *et al.*, 1990 ; ROCHA *et al.*, 1990 ; MOUTERDE, 1991 ; HENRIQUES, 1992 ; HENRIQUES *et al.*, 1994), based on its richness in ammonite representatives which show both North European (Graphoceratids) and Mediterranean affinities.

Serra da Boa Viagem road, turn west near Km 120 and before the lighthouse, towards Murtinheira village by the coast road). It provides an exceptional exposition along cliffs extending inwards for about 5 km (the northern flank of Serras da Boa Viagem and Alhadas) without significant facies variation or structural complication.

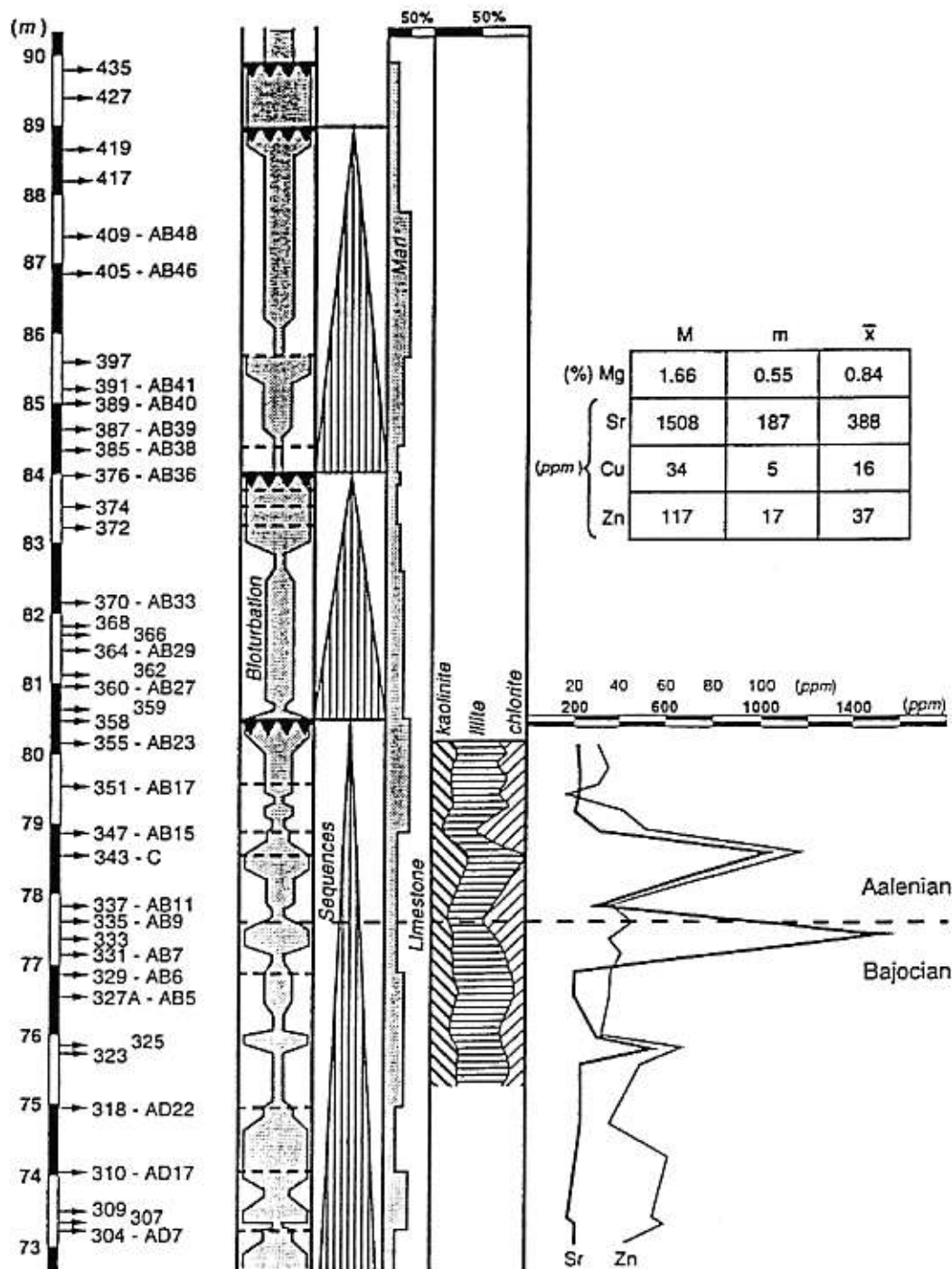


Fig. 2 - Mineralogical analysis of the clay fraction and geochemistry of major elements of the carbonate fraction (HENRIQUES *et al.*, 1994, *in press*).

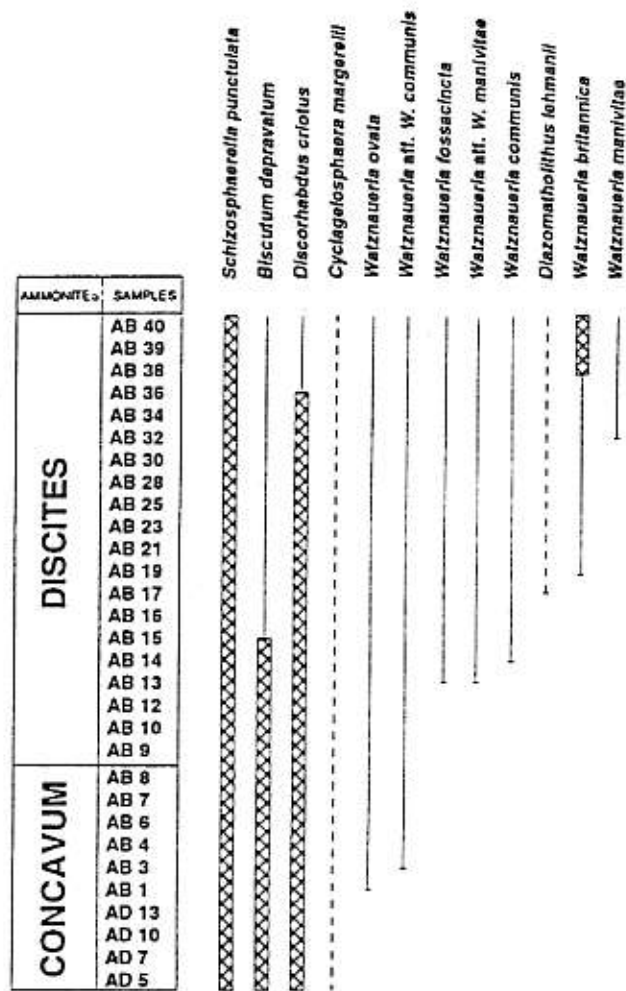


Fig. 4 - Main calcareous nannofossil assemblages across the Aalenian-Bajocian boundary (HENRIQUES *et al.*, 1994, *in press*).

3 - Completeness of exposure

The Aalenian-Bajocian boundary section integrates a continuous series of marine sediments ranging from Upper Toarcian to Middle Callovian with a thickness exceeding 400 m. This succession is particularly well exposed along the beach, defining a monoclinical structure with east-west development and about 30° dip towards south.

3.1 - The section

The Aalenian-Bajocian section corresponds to a more or less rhythmic alternation of gray limestones and marls, with bioturbation marks, sometimes very fossiliferous, with coal fragments and disseminated pyrite and very scarce celestite nodules. The strata are normally thin (0.15 to 0.25 m) and the stratification surfaces more or less irregular. The lenticular character of certain strata, or their local division by the interposition of marly films, more or less evident, can be observed (fig. 2).

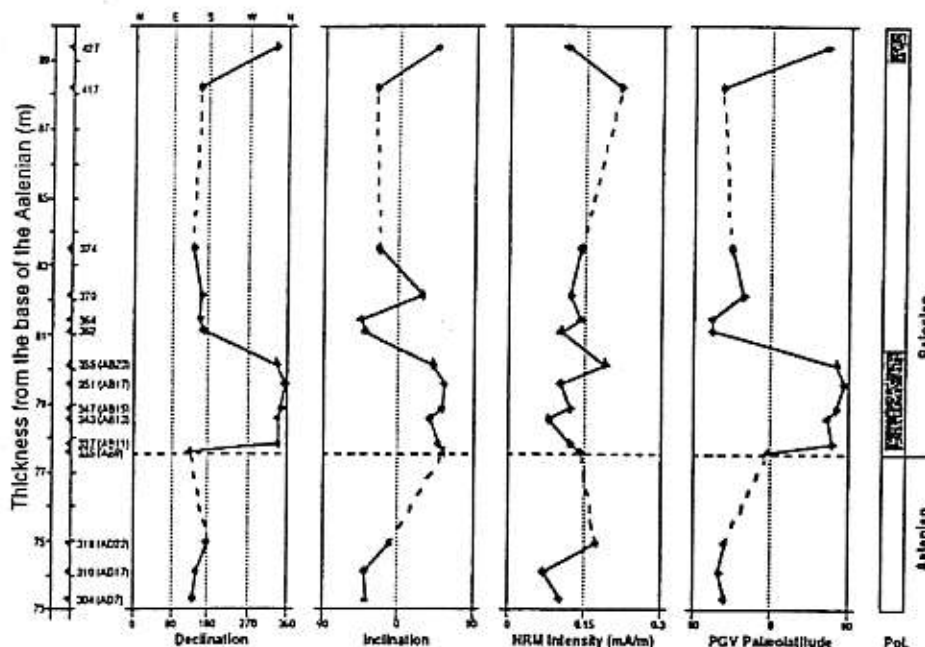


Fig. 5 - Magnetostratigraphic sequence through the Aalenian-Bajocian boundary at Cabo Mondego (HENRIQUES *et al.*, 1994, *in press*).

3.2 - The boundary

The Aalenian-Bajocian boundary in the Cabo Mondego section has been defined by the occurrence of the oldest representatives of *Hyperlioceras-Toxolioceras* group, that is, in bed AB 9 in former works (MOUTERDE *et al.*, 1972, SADKI, 1984 ; FERNANDEZ-LOPEZ *et al.*, 1987 ; FERNANDEZ-LOPEZ *et al.*, 1988 ; ROCHA *et al.*, 1990 ; MOUTERDE, 1991) or bed M335 in recent works (HENRIQUES, 1992 ; HENRIQUES *et al.*, 1994, *in press*) [fig. 3].

The calcareous nannofossils and the magnetostratigraphy study of this boundary are also very well known now, as well as the mineralogic analysis of the clay fraction and the geochemistry of major elements of the carbonate fraction (fig. 2).

4 - Abundance and diversity of well-preserved fossils

4.1 - Ammonoidea

The importance of the ammonite assemblages described in the Cabo Mondego section is a result of several evidences :

- the material is quite abundant and easy to sample ;
- it is well preserved as internal moulds providing easy identification ;
- in general, it includes for different taxa individuals representing different ontogenetic stages ; this fact is particularly evident for microconchs which are more frequent due to paleoecological, sedimentological and/or taphonomic reasons ;
- the material has been generally sampled in "remobilization levels" and corresponds to "ressedimentated entities" ("reworked" in english terminology, but contemporaneous to the sedimentation) ; from a taphonomic point of view, this material does not provide any interpretation problems, and from a biostratigraphic point of view it is entirely valid.

The definition of the Aalenian-Bajocian boundary is classically based on the first occurrence of *Taxoloceras* representatives (fig. 3). In the definition of this boundary it is particularly important the evolution pattern of Graphoceratid representatives. In the Cabo Mondego section, this family is represented by *Graphoceras*, *Taxoloceras*, *Hyperlioceras*, *Braunsina*, *Oedania* and *Reynesella*. They are associated with many other elements, presenting high frequency and diversity, and whose occurrence is quite relevant for correlation with other provinces (Hammatoceratinae, Sonniniidae, Oppelliidae, Otoitidae,...).

4.2 - Calcareous nannofossils

The study of calcareous nannofossil assemblages shows a gradual turnover across the boundary. It was possible to define two nannobiohorizons in the Concavum Zone and six biohorizons in the Discites Zone; a total of 28 species were identified. Most of the bioevents detected in these biozones show close similarities with other areas (fig. 4).

5 - Magnetostratigraphy

The intensity of magnetization of the rock samples in this section is generally weak, but is measurable using a triaxial high-sensitivity cryogenic magnetometer (a CCL-GM400). Thus, the mean natural remanent magnetization (NRM) intensity values, per level, lie between 6.7×10^{-4} and 2.2×10^{-4} A/m.

The NRM values have positive inclinations, but during demagnetization about 30% of the samples change polarity and at the end there are two groups of clear opposite polarity. The high stability component direction is similar to the Dogger direction for the Iberian Peninsula (Scott *et al.*, 1981) after applying the bedding-tilt correction which means it is previous to the tilting. Then it is clear that this component is a characteristic magnetization and represents a record of the geomagnetic field polarity at the time of the formation of the sediments.

The final results of the paleomagnetic field polarity record of the Aalenian-Bajocian boundary at Cabo Mondego are shown (fig. 5).

6 - Accessibility and conservation

The section has total accessibility to any geologist of any nation. It is localized a few Km from a touristic town (Figueira da Foz).

The classification as a natural Monument of the site and as a Protected Area of the whole Cabo Mondego region are on the way.

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BATHONIAN WORKING GROUP (BtWG)

C. MANGOLD, Convenor

Since the Poitiers Symposium (1990) so-called members of the Working group are in deep lethargy to judge by WG activities and purposes.

I am convinced that many people are busy with Bathonian biochronology and stratigraphy but I never received news about their works. Now it is time to undertake a renewal of the WG then we cannot leave things as they actually stand.

The last biochronological results are : (1) a proposal of the boundary stratotype section in the Digne area (Lisboa Symposium 1986, published in 1989) and (2) the biochronological charts of NW European and Mediterranean regions of France (Poitiers Symposium 1990, actually *in press*).

Concerning the first point no advancing was accomplished since Poitiers, and only 7 peoples return the voting form (*Newsletter* n° 21, p. 9). Therefore a new start must be given to the GSSP proceedings for the Bajocian-Bathonian boundary :

- 1 - continuation of biostratigraphical studies in the proposed Digne section specially micropaleontology. If some micropaleontologists are interested it will be very easy to collect samples after to get permission to M. MARTINI Director of the Réserve Géologique de Haute-Provence (Centre Saint-Benoît, 04000 Digne-les-Bains).
- 2 - Other candidate-sections can be proposed if studies are in a good progress but they must be notified as soon as possible to the convenor.

An informal meeting on the Bajocian-Bathonian boundary is planned to be held during May of 1995 at Digne.

To accelerate these proceedings, the convenor has dispatched to all known Bathonian workers a circular letter with a joined commitment answer form. He hopes on many answers and if so, he intend to send an inscription form for the Digne meeting.

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CIRCULAR LETTER

C. MANGOLD, Convenor

The Bathonian WG is in a sweet sleep to judge by the very few voting forms I received concerning the proposal of the Digne section as a boundary stratotype (*Newsletter* n° 20, enclosure 1). Only 7 answers returned to me : 6 accepting the proposal and I disagreeing with it because dinoflagellates, radiolarians, foraminifera have not been adequately documented. Thus for him the proposal is premature and he suggest to find a less limestone-rich section, in more deeper water environment, for instance on the Russian platform or Caucasus.

This small score cannot be taken into account to carry on with GSSP proceedings.

A follow-up appeal done in June 1993 (*Newsletter* n° 21, p. 9) was no more successful. In the same report of the Bathonian WG (*ibid.* p. 9, point 3) was proposed a field and workshop meeting at Digne for 1994 but none attached preliminary inscription form returned to the convenor.

Now it will be time to reorganize the Bathonian WG with people really interested by GSSP and Bathonian biochronology. My duty, before someone else take over the Bathonian W.G., is to achieve the submission on the proposal for a boundary stratotype, so the successor can choose other tasks in the future.

INTERNATIONAL SUBCOMMISSION ON JURASSIC STRATIGRAPHY (IUGS)

BATHONIAN WORKING GROUP

Convenor : Charles MANGOLD
 CENTRE DES SCIENCES DE LA TERRE
 UNIVERSITÉ CLAUDE-BERNARD LYON I
 27-43, boulevard du 11 Novembre 1918
 F-69622 VILLEURBANNE Cedex
 Phone : (33) 72.44.83.76 - Fax : (33) 72.44.83.82

Please fill up and return this form to the convenor



SURNAME : FIRST NAME :
 ADDRESS :

 PHONE : FAX :

• I am interested in Bathonian stratigraphy

- mainly in :

- . biochronology and biostratigraphy
- . sedimentology
- . sequence stratigraphy
- . magnetostratigraphy
- . paleontology

group(s) :

- . ecology
- . biogeography

- geographic area(s) :

• I want to be a member of the WG

- as an active member..... YES NO
- as an ordinary member..... YES NO

• I accept to work with the convenor for the WG team..... YES NO

Signature :

To begin the reorganization of the WG, an inscription form is attached to this circular-letter. Please give both the largest publicity round about you. I am full of hope and waiting for many answers.

From then on we are able to start for the Bathonian WG renewal with following steps :

- 1 - Creation of a WG leading crew.
- 2 - Organization of a field and workshop meeting in Digne during May of 1995 with :
 - visit of the boundary section proposed in Lisboa ;
 - examination of other candidate sections studied soon or in advanced study.
- 3 - Building up the file of the GSSP section for submission to the ISCJS and ICS.

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CALLOVIAN WORKING GROUP (CWG)

J.H. CALLOMON, Convenor

The situation is as follows. As you know, and as has been recorded in the ISJS Newsletters, a meeting was held in Albstadt, Swabia, in September 1990 to consider detailed proposals for the selection of a GSSP in a type-section at nearby Pfeffingen. The proposals were laid out in a document of some length, including an exposition of the principles of chronostratigraphy as practiced in the Jurassic since 1858. These proposals were accepted by the members of the Working-group present (18), *nemo contradicens*.

The next steps were to be the publication of these proposals, to elicit discussion, followed by a formal proposal for ratification to the Subcommission to forward to the ICS. The only obstacle has been shortage of time, for the preparation of such submissions is time-consuming. Not least of the diversions has been the writing of some more general reviews of the principles of stratigraphy by the Convenor, to meet the very point made by the Chairman of ICS in his circular letter of 3 June 1994 *re* a Symposium on Multidisciplinary Stratigraphy at the next IGC in Beijing. A firm resolve to have it ready for the next Jurassic meeting in Mendoza in October 1994 has, for personal reasons, also had to be abandoned. Nevertheless, late better than never : the matter will definitely be brought to a conclusion in the coming year.

One of the reasons for such optimism is that your Convenor has now formally retired and is thus freed from the increasingly burdensome time-wasting being imposed on universities by ignorant administrators. The down-side, however, is that what limited support there had been in the past in facilities and travel-grants will be strongly curtailed. Your Convenor therefore feels that the time has perhaps come for someone else to take over the Callovian Working-group, for whatever task it chooses to undertake after the basal boundary GSSP has been finally ratified.

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OXFORDIAN (OWG) AND KIMMERIDGIAN (KWG) BOUNDARY WORKING GROUPS

G. MELENDEZ & F. ATROPS, Convenors

Introduction

Activities of the Oxfordian and Kimmeridgian working groups have carried on since the last joint meeting at Warsaw, September 1992. General results of the meeting and the state of progress were summarized in the Newsletter n° 17, appeared by June 1993. A detailed account was included in the proceedings volume of the meeting, a special issue of *Acta Geologica Polonica*, which will appear soon this year. Therefore, this report will only cover the recent activities made by some active members of the group in order to progress in the task of selecting a good candidate for Callovian-Oxfordian and Oxfordian-Kimmeridgian GSSP, as regards the next general Jurassic Symposium in Argentina, in October 1994.

The current state of the problem

The main activities of the groups following the celebration of the Warsaw meeting were concerned with the recognition of the most suitable locality to be proposed as type section candidate for the Callovian-Oxfordian and Oxfordian-Kimmeridgian boundary. For obvious reasons, connected to the well-documented stratigraphic gap at the Callovian-Oxfordian boundary in Southern Europe, the most suitable sections to be proposed as stratotype locality are those located in some restricted, subsident basins, where the boundary beds are represented by clay, shaly facies. These are mainly to Oxford clay, in northern and eastern England (Yorkshire, Lincolnshire) and in Dorset (S England), and the so-called "Terres noires" facies in SE France.

As far as the Oxfordian-Kimmeridgian boundary is concerned, some of the most classical sections suitable to be selected as stratotype candidate were also in Great Britain : Isle of Skye in Scotland ; South Ferriby in Northern England and in Dorset, at Ringstead Bay. In Central and Southern Europe many regions appear to hold excellent exposures, from Western France (Aquitaine) to Poland. A remarkable progress has been achieved in the last ten years by the Kimmeridgian Group workers to recording and describing detailed sections through the Oxfordian-Kimmeridgian boundary and in order to define the precise stratigraphic position of the boundary (see the Warsaw Report, as mentioned above). The main problem here appears to be the sharp provincialism affecting the ammonite families, the main group to be taken into account for setting the biostratigraphic scales. Ammonite successions appear clearly different, showing just a few, to none, common elements from Boreal areas (Isle of Skye), to Subboreal (South Ferriby ; Dorset), Atlantic (Aquitaine), Submediterranean (SE France, E Iberia, Switzerland, S Germany) or true Mediterranean areas (Betic ranges, S. Spain).

At the present moment, the problems linked to the selection of the Oxfordian-Kimmeridgian boundary stratotype appear to be twofold. On one hand, the correlation problem : it seems that the base of the Baylei Zone, defined by the first record of representatives of the genus *Pictonia* could be correlated with the base of the *Amoeboceras bauhini* Subzone or horizon, and also with the base of the Galar Subzone, as recognized and normally defined in Southern Europe. This would turn of Oxfordian-Kimmeridgian boundary to be placed at the base of Galar Subzone, instead of at the base of Platynota Zone. Discussions and arguments at that point are still strong but an agreement seems to be near. Some of the best documented sections appeared to be in SE France, in the region of Ardèche (Crussol), and Subalpine chains, as described by the convenor of the group.

Type section candidates revisited

Therefore, the convenors and some members of the groups decided to organize a joint field trip to SE France, and a further one to Great Britain (Yorkshire ; Central England, and Dorset), in order to revisit and revise some selected sections to promote discussions and help deciding on the selection of the most suitable boundary stratotype sections. A first field trip was organised in May 1993 to SE France, led by F. ATROPS, D. MARCHAND and D. FORTWENGLER, to Dieulefit and Serres country. We had the chance to revise in detail the interesting ammonite collection of D. FORTWENGLER from the Terres noires ranging through the Upper Callovian-Lower Oxfordian. Some interesting sections were visited around the village of Serres, most specially the remarkable exposure at Thuoux and Saviournon, near Serres, which might well be proposed as the alternative future boundary stratotype candidate. The problem of defining the Callovian-Oxfordian boundary is connected with the characterization of the Oxfordian basal horizon, the *Cardioceras elizabethae* Horizon, at the base of the Scarborough Subzone. We also had the chance to visit the superb Upper Oxfordian to Kimmeridgian, up to Berriasian, section of Châteauneuf-d'Oze, near the village of Veynes and also, not far from Serres.

The detailed lithologic and palaeontologic recording of the sections included the sampling for microfossils and a first evaluation for future magnetostratigraphic studies. As far as this is concerned, the conditions of the outcrops appear generally good, despite of the dominant clay lithology. Thin limestone interbedding throughout the stratigraphic interval appears favorable although no magnetostratigraphic results are so far available. Reports on dinoflagellates and possibly forams should be ready by the next joint meeting, at Lyon, June 1994.

A second field trip to some of the most relevant Callovian to Kimmeridgian sections in Great Britain was subsequently programmed with the occasion of the Jurassic Arkell Symposium which was held in London, in September 93. The classical outcrops of Isle of Skye having to be left apart for the moment, because of the distance and the time available, the field trip concentrated on several classical Callovian to Lower Kimmeridgian sections around England, from Yorkshire to Dorset. The excursion was superbly programmed and led by John K. WRIGHT and by KEVIN N. PAGE and it involved six Oxfordian and Kimmeridgian working Groups members. Callovian to Kimmeridgian successions were revised in some classical outcrops in Yorkshire, Central England and in Dorset. The formerly proposed type section of the basal Oxfordian stratotype was visited, at Osgodby Nab, in Cornelian Bay, Scarborough. Some other relevant sections were visited around Peterborough, specially the remarkable outcrop of Warboys, showing a quite continuous succession through the lowermost to lower Middle Oxfordian. The main question here was connected with the precise identification of the lowermost, Elizabethae Horizon, at the base of Scarborough Subzone. The Oxfordian-Kimmeridgian boundary was revised at the classical outcrop in South Ferriby quarries and also in the Dorset coast, at Ringstead Bay. The first record of the genus is assumed as the paleontological criterion to set the base of the Baylei Zone. Both areas appeared idoneous for this purpose, although the problems here will be the availability of these sections to correlate with south-european successions, where this northern forms are absent. The search for a "bridge" area, with mixed ammonite successions is still open, and it will probably be the matter of interesting discussions in the meeting, at Lyon, 13th -18th June 1994.

The Callovian-Oxfordian boundary, finally, was also revised at the Dorset Bay. Again a good succession can be found in several points at the cliffs on the sea-side. They could serve as good reference sections. However, it seems that outcrops in Northern and Central England provide the most complete and expanded sections for this interval.

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THE 4th OWG-KWG MEETING, LYON - SE FRANCE, JUNE 13-18th 1994

The joint meeting of both Working groups will take place in Lyon University at Villeurbanne, from 13th to 18th. 17 members will attend the meeting and, after one day of discussions, the field trip will take the participants to the Upper Jurassic successions of SE France, in Crussol, Ardèche, Beauvoisin, Drôme and to the vicinities of Serres. The Callovian-Oxfordian transition ammonite successions will be revised in the particular collections of D. FORTWENGLER, in Dieulefit, and the classical outcrops of Thuoux and Châteauneuf-d'Oze will be visited, so it is expected that discussions should allow the members of the groups to get closer to an agreement on the most suitable sections to be proposed as stratotype candidate for the Callovian-Oxfordian and Oxfordian-Kimmeridgian boundary stratotypes. Lectures and discussions during the meeting sessions will focus on the boundary problems, and participants will also have the chance to revise the collections housed at the Paleontological Laboratory in University of Lyon.

OXFORDIAN WORKING GROUP (OWG)

G. Melendez, OWG Convenor

(with documentation on British sections kindly supplied by Kevin N. PAGE, Peterborough, Great Britain).

Introduction

The fourth Oxfordian-Kimmeridgian joint Meeting took place from June 12th to 18th 1994 in SE France. Some 18 participants from different countries of Europe and Asia attended the Meeting. It included one day of oral presentations and discussions at the University of Lyon-Villeurbanne and four-days field trip across SE France, including the visit to several outstanding and classical Oxfordian - Kimmeridgian localities. The historical regions of Crussol, Ardèche, Beauvoisin and Serres were visited and many Oxfordian-Kimmeridgian sections revisited. A final day was dedicated again at the University of Lyon for final discussions and conclusions.

The main purpose of the Meeting was to revise some relevant Callovian-Oxfordian transition sections in order to propose a potential GSSP candidate for the basal Oxfordian boundary Stratotype.

Suitability of british sections as basal Oxfordian boundary stratotype

A revision of some relevant Callovian-Oxfordian boundary sections in Great Britain was presented by K.N. PAGE. This report briefly summarizes the most favorable and disfavorable points of some classical sites as potential GSSP candidates for the Callovian-Oxfordian boundary.

1 - Redcliff Point, Weymouth, Dorset

- Pros : Apparently, the most complete section across the Callovian-Oxfordian in Britain. Good record of Paucicostatum Horizon to Scarburgense Subzone (Scarburgense Horizon). Oxford Clay Formation.

- Cons : Site liable to landslipping. Only brief mentions in the literature. No available detailed published record of faunas.

2 - Stanton Harcourt district, Oxfordshire

- Pros : Good development of Lamberti Zone, Henrici and Lamberti Subzones.
- Cons : · No future for long term preservation as a site.
· It could serve as complementary section for this interval.

3 - Woodham Pit, Buckinghamshire

- Pros : Classical description by different authors (ARKELL, 1939 ; CALLOMON 1968). Good succession of lowermost Oxfordian, Scarburgense Subzone.
- Cons : Site filled-in with waste since 1970's. Apparent gap of Paucicostatum Horizon, perhaps affecting partly the Scarburgense Subzone.

4 - Rookery Pit, Stewartby, Bedfordshire.

- Pros : Good paleontological record through the boundary (placed at the so called "Lamberti Bed". Site promoted for special protected Status (RIGS).
- Cons : Probable slight non sequence at the boundary partly affecting the Scarburgense Subzone. Condensed section at the boundary.

5 - Osgodby Nab, near Scarborough, Bed 9, Hackness Rock Mb.

- Pros : Relatively complete faunal sequence through the boundary, at this locality and the near Gunstone Nab. Good exposure of Paucicostatum and Scarburgense Horizon. Section already proposed and selected as stratotype for the base of the Oxfordian.
- Cons : High degree of condensation of the chamosite-oolite facies of the Hackness Rock.

The area of Scarborough is the type area for the Scarburgense Subzone.

6 - Staffin Bay, Isle of Skye, W. Scotland.

- Pros : Good successions across the Lamberti-Scarburgense Subzones.
- Cons : Callovian-Oxfordian boundary not-well documented at this locality. Faunas are virtually entirely cardioceratids. Little choice for accompanying ammonite groups.

As a whole, British selected sections show good ammonite succession across the Callovian-Oxfordian boundary. Most diversified ammonite associations appear at the southern (Dorset) sites, the site of Redcliff Point being probably the most suitable for selection as GSSP. They would also probably be more suitable for microfossils (Palynomorphs and Foraminifera) and magnetostratigraphic studies than French sites, although these studies are still unfinished.

French sections as potential GSSP candidates

Two prominent sites at the Dauphinois Basin (SE France, Serres) show remarkably expanded sections through the Upper Callovian-Lower Oxfordian under black shale, "Terre Noires" facies. Both sections, at the localities of Savournon and Thuoux, appear as valid candidates for Oxfordian stratotype, as an alternative to British sites.

1 - Savournon (c. Serres)

- Pros : Easily accessible, good exposure ; expanded lithologic succession through the Callovian-Oxfordian boundary, with no apparent stratigraphic gap at the boundary. Some more cemented marly limestone bands serve as good reference levels for stratigraphic succession. Rich ammonite contents makes succession easy to follow.
- Cons : Lithological succession sometimes obscured by small faults.

2 - Thuoux (c. Serres, some km away from Savournon).

- Pros : As for Savournon, lithological succession more expanded ; easily followed, although marly cemented bands are less evident than at Thuoux.
- Cons : Ammonite contents markedly less rich. Good and detailed collections are, however, housed at Lab. Geology, Lyon and at D. FORTWENGLER's, in Dieulefit, this collection being a detailed ammonite record through the Callovian-Oxfordian boundary in the region.

This section appears less favorable than Savournon for microfossil studies (Palynomorphs, Forams).

Concluding remarks

As a whole, British sections show apparently better conditions for microfossil analyses and, probably, magnetostratigraphic studies. However, the condensed character of many of the successions, the frequent presence of stratigraphic gaps make the french selected sections more suitable to be proposed as potential candidates for basal Oxfordian boundary stratotype.

Magnetostratigraphic studies in these localities will be tried soon by sampling the more calcareous levels. On what concerns the current microfossil studies, (N. POULSEN, pers. comm. and proceedings of the Meeting), the section of Savournon offers much better conditions for the study of the different groups, Dinoflagellates, Nannoplankton, and Forams. Ammonite successions also support clearly the Savournon section as most idoneous.

A proposal will be therefore, tentatively presented at the next Jurassic Congress in Argentina (October, 1994), to select the Savournon section as official candidate for basal Oxfordian boundary Stratotype. The section of Thuoux being equally important, the proposal will include the area at the surroundings of Serres, with the important outcrops of Savournon and Thuoux as complementary references.

References

- ARKELL, W.J. (1939) : The ammonite succession in the Oxford clay at the Woodham Brick Pit. Akeman street, Buckinghamshire, and its bearing on the classification of the Oxford clay. *Quat. Jl. geol. Soc. Lond.*, 95 : 122-135.

CALLOMON, J.H. (1968) : The Kellaways beds and Oxford clay. In : Sylvester-Bradley P. and Ford (eds). *The Geology of the East Midlands. Leicester University Press*, 264-290.

PAGE, K.N. (1994) : A review of the suitability of Key British Callovian-Oxfordian and Oxfordian-Kimmeridgian sites as Global stratotype sections and Points (GSSP) for Stage boundaries. IV Oxfordian-Kimmeridgian Meeting. Lyon, 1994 : *Doc. Lab. Géol. Lyon*, vol. special. (*in litt.*).

KIMMERIDGIAN WORKING GROUP (KWG)

F. ATROPS, KWG Convenor.

The strong provincialism shown by the ammonite faunas at the Upper Oxfordian and Lower Kimmeridgian has always made the correlations from difficult to entirely hypothetical with the Boreal realm to which the type area of Dorset belongs, and hence the recognition of the Oxfordian-Kimmeridgian boundary within the Mesogean realm, where a different zonation has to be used. So, the main problem is to correlate the boreal and mesogean ammonite successions. It was the matter of many discussions and one of the main debates during the Lyon Meeting. Recent progress in the knowledge of ammonite successions in both the Boreal and Mediterranean realms has supplied some possible answers to a long time delayed correlation problem. Four communications dealt with the Oxfordian-Kimmeridgian boundary. The excursions in the Southeastern France basin allowed to visit some classical sections for the study of the Oxfordian-Kimmeridgian passage levels.

I - The Oxfordian-Kimmeridgian boundary

1 - Suitability of British sections as basal Kimmeridgian boundary stratotype

According to K. PAGE (communication during this Meeting) three classical sites have potential as GSSPs for the Oxfordian-Kimmeridgian boundary in Great Britain : cliffs West of Osmington Mills, near Weymouth, Dorset ; South Ferriby Quarry, Humberside ; Staffin Bay, Isle of Skye, Western Scotland. This site, which has no conservability problems, no stratigraphical condensation, and also includes a mixture of boreal and sub-boreal taxa, is regarded as the best section by K. PAGE.

The Weymouth district (Dorset) and South Ferriby sections were visited in September 1993 by six Kimmeridgian Working Group members, under the guidance of J.K. WRIGHT and K.N. PAGE.

2 - The Oxfordian-Kimmeridgian boundary in the Boreal realm

BIRKELUND & CALLOMON (1985) showed that the Bauhini Subzone, first considered as the last subdivision of the Late Oxfordian boreal zonation (SYKES & CALLOMON, 1979) should be entirely transferred into the Kimmeridgian and that the lower boundary of this Subzone should correlate with the base of the Baylei Zone. This was based on the finding of the species *Amoeboceras bauhini* (OPPEL) at the lower horizon of the Baylei Zone (= the Densicostata Horizon) in both the Boreal (Skye island sections, Scotland) and the Subboreal provinces (Dorset, S England and South Ferriby, E England : BIRKELUND & CALLOMON, 1985 ; WRIGHT,

1989). In these localities, the species is associated with the first record of the genus *Pictonia*. The authors showed that the species *A. bauhini* is replaced at the upper horizon of the Baylei Zone (i. e. the Baylei Horizon including the species *Pictonia normandiana*), by the new form *A. bayi* BIRKELUND & CALLOMON. So, it is possible to use a common zonal scheme for both the Subboreal and Boreal provinces. It is suggested that the basal Kimmeridgian boundary should be drawn at the base of the Densicostata Horizon of the Baylei Zone (SYKES & CALLOMON, 1979). The progress in the knowledge of the Cardioceratids (*Amoeboceras*) succession at the base of the Kimmeridgian appears particularly useful for setting the precise position of the Oxfordian-Kimmeridgian boundary in the Submediterranean province.

3 - The Oxfordian-Kimmeridgian boundary in the Mesogean realm

a - Towards a solution : the arguments

In the Mesogean realm, the Upper Oxfordian-Lower Kimmeridgian zonation is not based on the Cardioceratidae or Aulacostephanidae but, most essentially on the representatives of Ataxioceratidae, Aspidoceratidae and Oppeliidae, which are of no use for correlation with the boreal realm.

In the Submediterranean province, the position of the Oxfordian-Kimmeridgian boundary was, during a long time, matter for discussion. But, since the work of GEYER (1961), the Kimmeridgian stage has traditionally been considered to start at the Platynota Zone, just above the Planula Zone, Galar Subzone of the Late Oxfordian. The Platynota Zone was regarded as equivalent to the boreal Baylei Zone. Previously, some authors (WEGELE, 1928 ; DIETERICH, 1940) placed the lower boundary of the Kimmeridgian, below, at the base of the new Planula Zone. ARKELL (1956) maintained a Planula Subzone as uppermost Oxfordian unit and accepted the *galar* levels as part of the Kimmeridgian stage, included in the Platynota Subzone of a wide Tenuilobatus Zone.

After GEYER's monograph (1961), ZIEGLER (1964) was the first one to consider the mesogean *Sutneria galar* levels as part of the Kimmeridgian rather than Oxfordian stage. SYKES & CALLOMON (1979, p. 857, 894) clearly showed that the problem of the basal Kimmeridgian stage boundary was still unresolved, stating that the whole, or at least a large part of the submediterranean Planula Zone should probably belong to the Kimmeridgian. Yet this conception, although reconsidered by ATROPS (1982), was still insufficiently supported.

For the last few years, progresses have been made to resolve this problem of correlation. So, the record of the boreal genus *Amoeboceras* in the Planula and Platynota Zones in several different areas of the Submediterranean province (S Germany : Swabia and Franconia ; Switzerland, SE France, S Poland) is particularly important for correlation with the boreal and subboreal schemes. Such *Amoeboceras* records, though, are generally scarce and occasional. They correspond to separate and distant horizons, related to punctuated arrivals or "invasions".

The most interesting *Amoeboceras* levels for the solution of this problem are :

- The level in the Planula -Costatum Horizon, at the base of the Planula Zone of Central Poland (WIERZBOWSKI, 1978 ; MATYJA & WIERZBOWSKI, 1988 ; WIERZBOWSKI, 1991 ; ATROPS *et al.* 1993). The authors set the Oxfordian-Kimmeridgian boundary at the base of the Planula Zone and regard the *Amoeboceras* recorded association as a highly variable assemblage grouped around the species *A. praebauhini* (SALFELD). The *bauhini* morphology would be already present in this association.

- The level recorded in the Galar Subzone in Southern Germany (BIRKELUND & CALLOMON, 1985) and Northern Switzerland (ATROPS *et al.*, 1993). These forms correspond truly to the species *A. bauhini* (OPPEL).
- The level found at the base of the Platynota Zone in SE France (= *Amoeboceras* Horizon, at the base of Polygyratus Subzone, Atrops, 1982) and Northern Switzerland (ATROPS *et al.*, 1993), comprising the species *A. bayi* BIRKELUND & CALLOMON.

The comparison of the stratigraphical range of the species *A. bauhini* (OPPEL) and *A. bayi* BIRKELUND & CALLOMON in the Boreal and Subboreal provinces with that in the Submediterranean province clearly shows that the Oxfordian–Kimmeridgian boundary can no longer be placed at the Planula–Platynota Zone boundary. According to the recent evidence, the Planula Zone would rather belong, at least partly (the Galar Subzone), if not all, to the Lower Kimmeridgian.

b - Discussion : the Oxfordian-Kimmeridgian boundary at the base of the Galar or the Planula Subzone ?

These two possibilities were the matter of the main discussions during the Meeting.

- *At the base of the Galar Subzone*

It was the solution proposed by ATROPS and MELENDEZ in the Kimmeridgian report of the Meeting and in the communication dealing with "the Oxfordian-Kimmeridgian boundary at the Iberian Chain (Eastern Spain) and SE France". It is based on the record at these levels of the true *A. bauhini*, whose presence at the base of the Baylei Zone in the Boreal realm is now well established. This proposition retakes those of ARKELL (1956) and BIRKELUND & CALLOMON (1985).

The faunal change recorded at the base of the Galar Subzone is well-marked. The genus *Subnebrodites* seems to have disappeared at this interval. Representatives of *Orthosphinctes* from this Subzone seem different from those of the Bimammatum Zone and Planula Subzone. On the contrary, ammonite associations from the Galar Subzone are very similar to those of the lower Platynota Zone (Polygyratus Subzone), so that the Galar-Platynota Zone boundary is usually very difficult to set in the absence of the successive forms of *Sutneria*. Now, it seems more appropriate to separate the Galar Subzone from the Planula Zone and to consider it as full zone at the base of the Kimmeridgian.

Sequence stratigraphy data seem also to give further support to this proposal in the S European Submediterranean province. The lower boundary of the Galar Subzone usually marks the beginning of the "Kimmeridgian sequence" recognisable by a sharp lithologic change, from limestone to a more marly series.

- *At the base of the Planula Zone*

Arguments towards setting the Oxfordian-Kimmeridgian boundary at the base of the Planula Zone were put forward by MATYJA & WIERZBOWSKI (1988), WIERZBOWSKI (1991) and ATROPS *et al.* (1993) who correlate it with the base of the Baylei Zone. The authors based this correlation on the record, in Poland, of the *Amoeboceras bauhini* morphology at the base of the Planula Zone, in an assemblage dominated by the species *A. praebauhini* (SALFELD).

This conception was supported once more by WIERZBOWSKI during the Meeting. In his communication "*Pictonia* analogues in the Submediterranean Jurassic and their stratigraphic importance" WIERZBOWSKI argued that the occurrence of possible *Pictonia* analogues in the submediterranean Planula Zone confirmed the *Amoeboceras* correlation of this zone with the lower part of the Baylei Zone of the boreal/ subboreal Kimmeridgian.

ZEISS presented a review of the ammonite succession in Southern Germany. He reminded that the *Amoeboceras bauhini* type comes from the upper Bimammatum Zone (Hauffianum Subzone), what corresponds to the data of WEGELE (1928). So, the whole Planula Zone, in which *A. bauhini* occurs, could be correlated with the *Amoeboceras bauhini* Subzone or Horizon (= Densicostata Horizon) of the lower part of the Baylei Zone.

II - South-Eastern France sections

The field trip allowed to visit four sections in the "Dauphinois" basin, two in the Ardèche margin (Crussol, Louyre), two in the Southern Subalpine Chains (Saint-Geniez, Châteauneuf-d'Oze). All these sections, represented by thick, continuous carbonate successions, allow detailed biostratigraphic studies for the Oxfordian-Kimmeridgian passage levels (from Bimammatum to Platynota Zone).

A reference section, or a complementary stratotype for the Submediterranean province could be chosen here, most particularly, perhaps, in the Ardèche margin, at the Crussol Mountain or at the Louyre ravine, where the stratigraphic succession appears complete and continuous for the whole upper Oxfordian-Kimmeridgian. But it is still necessary to know more precisely the ammonite succession in the Planula Zone.

At Crussol, it is important to note the presence of an horizon with the species *Amoeboceras bayi*, at the base of the Platynota Zone, which is represented by a thick series (17m). These species is only found at the top of the Baylei zone in the Boreal realm.

III - Concluding Remarks

The working programme for the time coming will include, as the main task, the choice of a site, in Great Britain, allowing a good definition of the Oxfordian-Kimmeridgian boundary in the Boreal realm. The Staffin Bay area, Isle of Skye, Western Scotland, seems the most suitable section to be proposed as potential candidate for basal Kimmeridgian boundary stratotype. This site has no conservability problem and also includes a mixture of boreal and sub-boreal taxa. So, it has a high potential for international correlation, at higher latitude at least (PAGE, this Meeting). But it needs further works to know exactly the ammonite succession (particularly the *Amoeboceras*).

In the Submediterranean province, the Oxfordian-Kimmeridgian boundary must be placed either at the base of the Galar or the Planula Zone. Discussions at this point are still strong but a solution seems to be close. The search of a "bridge" area with mixed ammonite succession is still open. Some of the best documented sections appears to be in SE France, in the region of Ardèche, as described by the convenor of the group, or in S Germany (Swabia and Franconia) as shown by ZEISS. In this area, the *Amoeboceras* of the *bauhini* group are not so rare. A systematic revision of *A. bauhini* is necessary and its precise stratigraphic position in the Galar and Planula Zones must be better known. A study of Planula Zone sections is planned for the next two years, in Germany, SE France and Poland, in order to resolve the correlation problem with the boreal succession.

In 1996, the next Kimmeridgian Working Group Meeting could be held in Isle of Skye (Scotland) or in S Germany.

References

ARKELL W. J. 1956 - Jurassic geology of the world. *Oliver & Boyd edit.*, London, 806 p.

- ATROPS F. 1982 - La sous-famille des Ataxioceratinae (Ammonitina) dans le Kimméridgien inférieur du Sud-Est de la France. Systématique, évolution, chronostratigraphie des genres *Orthosphinctes* et *Ataxioceras*. *Docum. Lab. Géol. Lyon*, **83** : 463 p.
- ATROPS F., ENAY R. & MELENDEZ G. 1993 - Joint meeting of the Oxfordian and Kimmeridgian Working Groups ; Warsaw, 7-12 September 1992. *Acta Geol. Pol.*, **43**, 3-4 : 157-168.
- ATROPS F., GYGI R., MATYJA B. A. & WIERZBOWSKI A. 1993 - Ammonite succession in the Middle Oxfordian-lowermost Kimmeridgian, Submediterranean succession, and their correlation value. *Acta Geol. Pol.*, **43**, 3-4 : 213-227.
- BIRKELUND T. & CALLOMON J. H. 1985 - The Kimmeridgian ammonite faunas of Milne Land, central East Greenland. *Gronlands Geol. Undersogelse*, **153** : 1-56.
- DIETERICH E. 1940 - Stratigraphie und Ammonitenfauna des Weissen Jura beta in Württemberg. *Jh. Ver. vaterl. Naturk. Württemberg*, **96** : 1-41.
- GEYER O. F. 1961 - Monographie der Perisphinctidae des unteren Unterkimmeridgium (Weisser Jura gamma, Badenerschichten) im süddeutschen Jura. *Palaeontographica*, **A**, **117**:1-157.
- MATYJA B. A. & WIERZBOWSKI A. 1988 - The two *Amoeboceras* invasions in submediterranean Late Oxfordian of central Poland. *2nd Intern. Symp. Jurassic Strat.*, Lisboa (1987), **1** : 421-432.
- SYKES R. M. & CALLOMON J. H. 1979 - The *Amoeboceras* zonation of the Boreal Upper Oxfordian. *Palaeontology*, **22**, 4 : 839-903.
- WEGELE L. 1928 - Stratigraphische und faunistische Untersuchungen im Oberoxford und Unterkimmeridge Mittelfrankens. *Palaeontographica*, **LXXI** : 117-210.
- WIERZBOWSKI A. 1978 - Ammonites and stratigraphy of the Upper Oxfordian of the Wielun Upland, Central Poland. *Acta Geol. Pol.*, **28**, 3 : 229-333.
- WIERZBOWSKI A. 1991 - Biostratigraphical correlations around the Oxfordian/Kimmeridgian boundary. *Acta Geol. Pol.*, **41**, 3-4 : 149-155.
- WRIGHT J. H. 1989 - The early Kimmeridgian ammonite succession at Staffin, Isle of Skye. *Scott. J. Geol.*, **26**, 3 : 263-272.
- ZIEGLER B. 1964 - Das untere Kimeridgien in Europa. In : Colloque Jurassique, Luxembourg, 1962. *C. R. Mém. Inst. Gd Duc., Sc. nat., phys. math.* : 345-354.

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TITHONIAN WORKING GROUP (TWG)

A. ZEISS, Convenor
Report by the Secretary, F. Cecca.

ARKELL Symposium on Jurassic Geology, London, September 1993

A meeting of our Working Group was held sept. 11th during a break of the Symposium program. The following colleagues participated : J. CALLOMON, F. CECCA, A.L. COE, J.W. C. COPE, B. COX, I. FÖZY, J. GEYSSANT, N. MORTON, E. PROSOROVSKAYA, J. REMANE, A. RILEY, I. SAPUNOV, W. SARJEANT, A. ZEISS.

The discussion was opened by the Chairman who stressed the need to select a suitable boundary stratotype section for the lower boundary of the Tithonian. This is the main task of our Group but no proposals have been formulated so far. Thus, in agreement with the recommendations of the Chairman of the ISJS, Prof. R. ENAY (ISJS *Newsletter* n° 21), we have to concentrate our efforts and reach a formal proposal in a relatively short time.

The discussion is summarized as follows.

COPE agreed with ZEISS about the importance of the selection of a reference section.

ZEISS recalled that whilst we have no problems to define the boundary, i.e. the base of the Hybonotum Zone, we do not know the faunas in detail. This would help us for the establishment of reliable correlations.

MORTON stressed the importance of the selection of regional boundary stratotype sections or "secondary stratotypes".

SARJEANT did not agree the choice of a stratotype in the Mediterranean area because palynomorphs are absent whilst they are frequent in Dorset.

FÖZY informed the participants that in Hungary the boundary is recognizable although the faunas are sometimes poorly represented.

CECCA stressed the paradox of the Kimmeridgian-Tithonian boundary in the Mediterranean regions : we are able to recognize the base of the Hybonotum Zone in Spain Southern Alps, Apennines, Hungary etc..., but we cannot select a good boundary stratotype section because the thickness of the fossiliferous deposits are usually reduced.

It has been decided to prepare proposals of secondary stratotypes for the following areas : Hungary, Subbetic Range (Southern Spain), Bulgaria, Apennines and Southern Alps (Italy). ZAKHAROV will be informed of this decision in order to propose a secondary stratotype for the Volgian region.

CECCA and ZEISS suggested to find a section where faunal overlapping between boreal (subboreal) and tethyan elements is documented, i.e. an area where *Hybonotoceras* and *Gravesia* co-occur. Together with Geyssant, they recalled the existence of two candidates in Southern France : Mount Crussol and Canjuers. In the latter section, *Hybonotoceras*, *Gravesia* and *Glochiceras lithographicum* co-occur. It is studied by ATROPS since many years, although nothing has been published so far.

New research work in Southern Germany may hopefully also help to find a suitable stratotype section.

All the participants decided to ask ATROPS (who was absent at this Meeting) to visit the Crussol and Canjuers sections in the occasion of the field trip organized for the Oxfordian and Kimmeridgian Working Groups in June 1994. This was, on the other hand decided at Poitiers in 1991.

Field trip in Southern France

The result of the contacts between the Chairman and the Secretary of the WG and ATROPS did not produce any definite program. In fact, due to the program of the Oxfordian and Kimmeridgian WGs Meeting, it is now impossible to add visits to the candidate sections discussed above.

ZEISS, ATROPS and ENAY are now studying a solution for a field trip in 1995. The decision will be advertised in the next *Newsletter*.

Results of New Researches

SCHWEIGERT (Germany) has very recently published (see library section) two papers dealing with the K/T boundary in Suebia area, where faunal overlapping between tethyan and subboreal species exists. He studied both the subboreal ammonites from the systematic point of view (SCHWEIGERT 1993a) and the biostratigraphic implications (1993b), particularly the correlations between subboreal and mediterranean zonations around the K/T boundary. Further studies by SCHWEIGERT and ZEISS are in progress and we expect to present new useful data about the K/T boundary. The correlation (SCHWEIGERT & ZEISS, 1994) is reported below. It is worth noting that a hiatus seems to exist in Franconia between the *V. setatum* Subzone and the base of the *Hybonotum* (*Gigas*) Zone.

Researches in Progress

GRIGORE (Rumania), is carrying on the revision of the NEUMAYR's localities in East Carpathians (Lacu Rosu area) and in the Svinitza area (Southern Carpathians). He collected faunas from Lower Kimmeridgian up to K/T Boundary levels. The palaeontological study of the ammonites is in progress. GRIGORE thinks that it would be possible to find a suitable boundary stratotype section in the Lacu Rosu area.

PATHAK (India) is also very active. In cooperation with KRISHNA, new biostratigraphic informations have been provided from Kachchh area (1991). Furthermore *Hybonoticerias hybonotum* has been reported for the first time from the Tethyan Himalaya (PATHAK, 1993) in the Spiti Shales Formation. KRISHNA & PATHAK (1994) have just published important data on Upper Kimmeridgian and Lower Tithonian index ammonites of the Kachchh area.

K/T Boundary Library

The references of new papers concerning K/T boundary, Early Tithonian stratigraphy or also containing information on these topics are listed below.

CECCA F., FÖZY I. & WIERZBOWSKI A. (1994) - Ammonites et paléocéologie : étude quantitative d'associations du Tithonique inférieur de la Téthys occidentale. 3rd Int. Symposium "Cephalopods: Present and Past", Lyon, July 1990, *Geobios, Mém. spec.* 15 : 39-48, 4 fig., Lyon.

COPE J.C.W. (1993) - The Bolonian Stage : an old answer to an old problem. *Newsl. Stratigr.*, 28 (2/3) : 151-156, Berlin-Stuttgart.

KAZMER M. (1993) - Pygopid brachiopods and Tethyan margins. In PALFY J. & VÖRÖS A : Mesozoic Brachiopods of Alpine Europe. *Hung. Geol. Soc.*, 59-68, Budapest.

- KRISHNA J. & PATHAK D.B. (1991) - Ammonoid biochronology of the Upper Jurassic Kimmeridgian stage in Kachchh, India. *Journal Palaeont. Soc. India*, 36 :1-13.
- KRISHNA J. & PATHAK D.B. (1994) - Late Lower Kimmeridgian–Lower Tithonian Virgatospinctins of India : evolutionary succession and biogeographic implications. 3rd Int. Symposium "Cephalopods : Present and Past", Lyon, July 1990, *Geobios*, Mém. Spéc. 15 : 227-238, 4 fig., Lyon.
- KROBICKI M. (1993) - Tithonian-Berriasian brachiopods in the Niedzica Succession of the Pieniny Klippen Belt (Polish Carpathians) : paleoecological and paleobiogeographical implications. In PALFY J. & VÖRÖS A. : Mesozoic Brachiopods of Alpine Europe. *Hung. Geol. Soc.*, 69-77, Budapest.
- OLORIZ F., SARTI C. & TAVERA J.M. (1993) - Simospiticeras (Ammonitina) : una forma rara ma tipica nel Titoniano superiore della Tetide Mediterranea. *Boll. Soc. Paleont. It.*, 32 (3) : 265-275, Modena.
- ONDREJICKOVA A., BORZA V., KORABOVA K. & MICHALIK J. (1993) - Calpionellid Radiolarian and Calcareous Nannoplankton association near the Jurassic-Cretaceous boundary (Hrusové section, Cachtické Karpaty Mts., Western Carpathians. *Geologica Carpathica*, 44 (3) : 177-188, Bratislava.
- PATHAK D.B. (1993) - The first record of the ammonite genus *Hyboniticeras* from the Himalaya and its biostratigraphic significance. *Newsl. Stratigr.*, 28 (2/3) : 121-129, Berlin-Stuttgart.
- PROSOROVSKAYA E. (1993) - Brachiopods at the Jurassic-Cretaceous boundary from the Ukrainian Carpathians, Crimea, Caucasus and Transcaspian region. In PALFY J. & VÖRÖS A. : Mesozoic Brachiopods of Alpine Europe. *Hung. Geol. Soc.*, 109-112, Budapest.
- REHANEK J. & CECCAF. (1993) - Calcareous dinoflagellate cysts biostratigraphy in Upper Kimmeridgian - Lower Tithonian pelagic limestones of Marches Apennines (Central Italy). *Revue Micropaléontologie*, 36 (2) : 143-163, Paris.
- REHANEK J. & HELIASZ Z. (1993) - Microfacies and microbiostratigraphy of the Oxfordian–Lower Kimmeridgian, on the basis of Cadosinids and Stomiosphaerids in the Czestochowa region of Poland. *Geologica Carpathica*, 44 (2) : 81-93, Bratislava.
- SARTI C. (1993) - Il Kimmeridgiano delle Prealpi veneto-trentine : fauna e biostratigrafia. *Mem. Museo Civ. Storia Nat.*, Verona, IIa serie, Sez. Sc. Terra, 5 : 9-145.
- SCHWEIGERT G. (1993) - Die Ammonitengattungen *Gravesia* SALFED und *Tolvericerus* HANTZPERGUE und ihre Bedeutung für den Grenzbereich Oberkimmeridgium/Untertithonium im Schwäbischen Jura. *Geol. Bl. NO-Bayern*, 43 (1-3) : 167-186, Erlangen.
- SCHWEIGERT G. (1993) - Subboreale Faunenelemente (Ammonoidea) im oberen Weissjura (Oberkimmeridgium) der Schwäbischen Alb. *Profil*, 5 : 141-155, Stuttgart.
- SCHWEIGERT G. & ZEISS A. (1994) - 4.1 Ammonite biostratigraphy of the Upper Kimmeridgian to Tithonian of southern Germany. In : LEINFELDER R.R. *et al.* : The origin of Jurassic reefs. Current research developments and results. *Facies*, 31, 24, Erlangen.
- STEVENS G.R. (1992) - The New Zealand Late Jurassic : age assessments based on ammonite faunas. *Geol. Soc. of New-Zealand-Miscellaneous Publ.*, 63A, 148.

Note

To simplify the issue of the *Newsletter*, all the reports, informations etc. which you wish to publish in the *Newsletter* should be addressed directly to Dr. F. CECCA, whilst those concerning the work of the Subcommission to Prof. A. ZEISS.

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JURASSIC MICROFOSSIL GROUP (JMG)

D. HULL, convenor

The Jurassic Microfossil Group (formerly the Jurassic Micropaleontology Working Group) is an informal group of the ISJS, and as such has held no meetings since the past meeting of the ISJS in Poitiers, France. The current membership includes approximately 167 members, and a computer database has been established for all members which includes individual addresses, specialities, current projects, and recent publications.

Two newsletters (one each in 1992 and 1993) have been produced by the secretary: one more will be published and mailed to members during the summer of 1994. *Newsletters* include information on upcoming meetings within and outside of the ISJS, summaries of current projects of JMG members, informal advertisements for microfossil publications, recent publications of JMG members, summaries of working group meetings, and requests for samples/exchanges. A directory of members should be available at the upcoming Subcommission Meeting in Argentina in October. A meeting of the JMG will also be held during this meeting to discuss the status and future of the Jurassic Microfossil Group.

3. SEQUENCE STRATIGRAPHY



3. SEQUENCE STRATIGRAPHY

In June 1993, and again in September (owing to the few answers he received), the Bureau of the ICS undertook a survey on Sequence Stratigraphy and asked the subcommissions for comments regarding the inclusion of Sequence Stratigraphy in the International Stratigraphic Guide. The letter from the ICS was enclosed in the *Newsletter* n° 21, in order to "communicate with the members of (the) subcommission to find out about their experiences and opinions on Sequence Stratigraphy".

You have been acquainted with the situation by the letter dated January 13, 1994. At the same time, the two only responses we received were sent to the ICS together with the own comments by the Chairman and Secretary just below. In no way they may not to be considered as the subcommission opinion !

3.1. - ISJS BUREAU COMMENTS ON SEQUENCE STRATIGRAPHY SENT TO ICS

Using answers from O. MICHELSEN and T.P. POULTON

1 - Sequence Stratigraphy is surely an important – partly – new method in basin analysis besides the other stratigraphic methods. So it is important as a means of pulling many different disciplines together toward a better understanding of sedimentary rocks, as expressed by POULTON.

2 - Most sequence stratigraphic concepts (as the term Genetic Stratigraphy itself) have a subjective character and for that reason are not amenable to regulation. We agree that any premature codified treatment of Sequence Stratigraphy would have the negative results as POULTON wrote.

3 - Regulation would be useful for non interpretative aspects to Sequence Stratigraphy units e.g. precise definitions of the units by individual authors who use them (base and character of the units). But nothing implying unproven correlations e.g. hierarchical units.

4 - In any case Sequence Stratigraphy units are bounded by unconformities and enter the chapter 6 (Unconformity Bounded units) of the Code and not "as independant of the existing disciplines" (O. MICHELSEN). But this fact does not make these units equal to chronostratigraphic unit. The geological age of a Sequence Stratigraphy unit still has to be determined by other stratigraphic methods, e.g. biostratigraphy.

5 - To consider published Sequence Chronostratigraphy and Eustatic Sea Level Curve (cf. HAQ *et al.*) as a reference for dating or correlation (as some people do) is very dangerous. In the way numbering the cycles boundaries in accordance with numerical ages does not make sense (unless to consider there as only hypotheses) especially for Jurassic Time : it depends on the chosen numerical scale ; the interval of error around the mean age is of the same value as stages duration ; very few valuable radiometric data, etc.

6 - The most important is : first, to realize well performed Sequence Stratigraphy analyses based on well defined units ; then, to present a real documentation of the chronostratigraphic validity of the chronostratigraphic correlation with the published "charts", using all other stratigraphic method e.g. biostratigraphy ; if not we risk to be arguing in a circle.

A few more answers were received from the beginning of the year. Too late to affect the ICS decisions. They give a better idea of the various opinions or experiences within the members of the Subcommittee. You are able to judge by yourself at the answers we received being published p. 58-64.

In the meantime, the proposal for a "Committee on Genetic Stratigraphy" made progress and was established through the proceeding of the last business meeting of the bureau of the ICS in Neuchâtel, Switzerland, April 6-7 1994 :

"1.2. Establishment of a Committee on Genetic Stratigraphy (CGS) :

Following the prevailing favorable responses by the Subcommissions to a survey by the Bureau on Sequence Stratigraphy, the Bureau proposes to the Full Commission the establishment of a Committee on Genetic Stratigraphy, to embrace sequence, event, and cyclic stratigraphy. Out of 21 Voting Members, effective March 21, 20 members approved the proposal and one objected.

The Secretary solicited from the Subcommissions, by May 15, nominations of qualified individuals to serve on the Committee.

The definition of Genetic Stratigraphy and a mission statement for CGS were prepared by the Secretary.

The following future actions are planed :

- Identifying contacts with the IUGS Commission on Global Sedimentary Geology. That Commission is organized into working groups, one of which deals with the sedimentary aspect of sequence stratigraphy and sea-level changes, and another with cyclostratigraphy.
- Establishing CGS as an international organization and recruiting collaborators (participation of Secretary at the AAPG/SEPM convention in Denver, Colorado on June 12-15 for a promotional presentation).
- Organizing a workshop for publication of the project (with NATO sponsorship ?)".

As you surely realized the Chairman of the ISJS approved the proposal. Owing to the little interest the members showed we did not propose any qualified individual to serve on the Committee. We fear it will be too late now, bu the Bureau intend to propose the past Secretary of the ISJS, Dr O. MICHELSEN.

He was one of the peoples who answered in time and the letters we exchanged prove its interest for Sequence Stratigraphy. In his last letter, received during July, he recalls opportunately : "some years ago Arnold ZEISS and I discussed if we should have a working Group on this theme in parallel with e.g. the microfossil Group".

So, in connection and to insure contact with the ICS Committee, the question is laid down again to establish a Working Group on Sequence Stratigraphy within the Subcommittee.

3.2. - MEMBERS COMMENTS

O. MICHELSEN, Arhus, July 1st 1993

I find it to be an important matter for ICS to take up the aspects of sequence stratigraphy. This stratigraphic concept is rapidly evolved during these years, and a lot of work is carried out. The last 3-4 years I have worked intensively with sequence stratigraphic analysis of the Cenozoic section in the North Sea, and to some degree with Danish Jurassic. Besides minor papers a large paper is prepared for a book which will be published next year. It is edited by P.C. DE GRACIANSKY (Paris), Peter VAIL and others. The agenda of this book, especially vol. 1, clearly shows to me that ICS has to deal with this matters. Not only stratigraphic "disciplines" like chronobiostratigraphy and chronomagnetostratigraphy, will be treated in the book, but also "sequence chronostratigraphy". All three "stratigraphic disciplines" are by their names a little confusing in relation to the traditional HEDBERG-terminology.

Sequence stratigraphic units are of chronostratigraphic significance alone by its concept. They are like allostratigraphic units bounded by unconformities. But this fact does not make these units equal to chronostratigraphic units. The geological age of a sequence stratigraphic unit still has to be determined by other stratigraphic methods, e.g. biostratigraphy. The evolution of the sequence stratigraphic analysis makes it possible some times to establish a sequence stratigraphic scheme with a more detailed resolution than that of the controlling biostratigraphy. This is at least the case in the Neogene section I have worked with.

Peter VAIL and his group believe the eustatic sea-level changes to be controlling factor of sequences. They therefore numbered the cycle boundaries in accordance with numerical ages, which is in my opinion very dangerous for any stratigraphic conclusion and without scientific control. Many papers published in these years are based on a well-performed sequence stratigraphic analysis leading to a sequence stratigraphic scheme, which subsequently are correlated with the published (HAQ *et al.*) eustatic sea-level curve. A real documentation of the chronostratigraphic validity of this chronostratigraphic correlation is often missing. This means that arguing in a circle may be the case instead of presenting a scientifically valid discussion and conclusion.

I can therefore recommend that ICS include sequence stratigraphy in the stratigraphic classification as independant of the existing disciplines.

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T.P. POULTON, Calgary, July 7, 1993

I have been asked to comment on the same matter by a member of the North American Commission on Stratigraphic Nomenclature who is studying the question for possible treatment in the next North American Code, so that I have given it a little thought, although I find I have mixed feeling on many items. I enclose the response sent recently to the NACSN, which I hope will serve your purposes.

I find sequence stratigraphy to be a wonderful (but not very new) means of pulling many different disciplines together to work toward a better understanding of sedimentry

rocks. There are many different methods currently being used, under the name Sequence Stratigraphy and it would be useful to see some standards accepted. This will not happen for a few more years though, until ideas are sorted out by the scientific community, not by legislation.

Any ideas that are legislated prematurely will not be well received and will make the Guide less credible.

To : D.G. Cook, D. OWEN
From : T.P. POULTON

Re : Sequence Stratigraphy in Code

I promised to record some thoughts about incorporating sequence stratigraphy into the revised Code. I cannot claim to have thought this through very thoroughly, but here is what I offer.

I am inclined to agree with Pratt, HARLAND, and others that most sequence stratigraphic concepts are not amenable to codification because of their subjective character. This is an entirely different concept from their being in an unstable state of flux which is as much a result of the youth of the concepts and the large amount of research and discussion going into them, as it is to the interpretive aspect.

At present there are at least three sets of entirely different criteria for assigning boundaries to sequence packages. Some, such as EXON emphasize unconformities (and correlative conformities, whatever that means). Others involve a variety of other surfaces which draw attention to different stages of interpreted regression, transgression, etc.

With new concepts and new types of units being developed almost annually, it is an easy prediction that any premature codified treatment of sequence stratigraphy would be 1) outdated quickly, 2) the subject of criticism by large numbers of workers, and 3) ignored to a lesser or greater degree. I find it highly unlikely that premature regulation will inhibit research and the development of new concepts, more likely reading and applying the Code would be inhibited.

On the other hand, there are noninterpretive aspects to sequence-stratigraphic units and a case can be made that it would be a service to see them regulated. These involve providing for precise definition of the units by individual authors who use them, i.e. the base and character of the units must be clearly defined in a stratotype. Only by correlating away from a single horizon at a single outcrop or borehole can units be adequately dealt with, and only in this way will the rigor required to shed light on global synchronicity be advanced.

Beyond requiring stratotype and base definitions, nothing implying unproven correlations should be codified, certainly not the hierarchical units designated variously as 1st Order, 2nd order, etc., J1, K2, etc. That is, only the procedure for defining units (based on the Golden Spike stratotype concept) should be codified, not the scale or succession itself.

There is not the slightest doubt that requiring the definitions I propose above would result in an avalanche of definitions of a great number of different types of units which would overwhelm the literature. This would be made worse by the multiple treatments that would be accorded to particular horizons at particular stratotype localities which must be fitted into a variety of different sequence stratigraphic interpretations. On the whole I would view this as an undesirable, time- and paper-occupying legalistic nightmare. Therefore the only aspect of sequence stratigraphy that might be useful to see codified is logistically undesirable.

In terms of guidance rather than regulation, the Code could be useful in encouraging rigor in the clarity with which units and concepts are treated in the literature, especially those which are newly proposed and for which formal definitions might be in order.

HARLAND (1992, GSA Bull. p. 1234) makes good points in proposing that minimum regulations and more extensive guidelines be separated into two different volumes, or at least clearly distinguished within a volume. There is a clear need for a concise compilation of recommendations and guidelines (partly for discussion purposes), but there is also a need (a different need) for regulations that apply to definitions. Sequence stratigraphic recommendations should not be closely associated with a more widely accepted and more authoritative Code.

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J. THIERRY, DIJON, 20.07.93

Il me semble nécessaire de dire qu'un nombre de stratigraphes du Jurassique français sont intéressés par cette approche et qu'ils travaillent dans ce sens. Pour ma part (et celle des Dijonnais tels que B. LAURIN, D. MARCHAND, J.P. GARCIA et J.H. DELANCE) il y a des contributions possibles dans un cadre "Rôle de la biostratigraphie en stratigraphie séquentielle". De plus, il faut savoir que les écoles sont partagées (voir les différences GUILLOCEAU, HOMEWOOD etc et VAIL, JACQUIN etc). Même si peu de français auront les moyens d'aller à Pékin en 1996, il y a des possibilités de collaboration et nous sommes ouverts à toutes suggestions.

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G. MELENDEZ, MADRID, 01.03.94.

Sequence Stratigraphy : There is not much I can say about this 'new' method in basin analysis. I generally agree and regard the overall principles as valid and interesting, specially for correlation and basin-evolution analysis. The main problems, in my opinion, would be that :

- 1) In Jurassic outer shelf carbonate facies the biostratigraphic analysis sometimes alters the general eustatic sequence frame (because, generally, of the very precise evaluation we can have of the extent of the gaps by means of ammonites) making sometimes difficult to distinguish between main sequences, sequences, para-sequences and sub-para-sequences, etc.
- 2) In addition to that, many times the supposedly MFS is suddenly followed by a very quick evidence of shallowing, making it suspect that this "maximum flooding" event was not so maximum, or the things were a bit more complex.
- 3) Even more, the local tectonics usually contributes too often to further alterate the theoretical scheme and dogmas. Things may sometimes offer exactly the reverse situation as could be supposed to be, due the local uplift of an emerged massif, etc.

I am not trying, of course, to neglect any interest or validity to this theoretical body of knowledge (I have recently been involved in some interpretations of Callovian to Kimmeridgian successions of the Iberian Chain in this sense). But I think, most of the problems arise normally in the different interpretation the discontinuities and gaps can be given. May be

some of the interpretations of sequences and systems tracts for the Middle and Upper Jurassic are still premature, and some of them I do clearly disagree with, e.g. the recently assumed Callovian-Oxfordian boundary transgressive event. My feeling is that a quite long way of biostratigraphic, taphonomic and sedimentological complementary work is still ahead.

I will encourage my colleague Dr. Marc AURELL, however, to prepare a short report on the main possibilities and results of sequence Stratigraphy analysis in Jurassic carbonate series, mostly in Iberian Chain, to be included in the ICS report.

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M. AURELL, ZARAGOZA, 28.2.1994

- 1- Sequence Stratigraphy – a tool developed back in the 1970s – has been proved useful in the documentation of the evolution of sedimentary basins, which are considered to be filled by successive unconformity-bounded units or depositional sequences. The history of the infill of the sedimentary basin must be understood as the interplay of several related factors such as subsidence, local synsedimentary tectonics, possible eustatic fluctuations of several orders and the sedimentary input and/or carbonate production.
- 2- Systems tracts are considered as descriptive entities and should be defined on the character of their bounding surfaces, their position within a sequence and their facies distribution patterns. Systems tracts are not necessarily interpreted in terms of eustatic fluctuations. The facies distribution in sequences and systems tracts is determined by the accommodation rates and the rates of sedimentation and/or carbonate production.
- 3- Our experience in the Upper Jurassic of the Iberian basin shows :
 - (1) Identification of sequences and systems tracts should be based on extensive facies analysis across proximal, middle and distal areas of the basin ;
 - (2) Precise biostratigraphic data is necessary in order to both correlate facies and to allow interpretation and dating of sequence and systems tracts boundaries (i.e., sedimentary hiatus, flooding surfaces, marine condensation...).
 - (3) In our opinion, the Exxon global cycle chart can never be used as a predictive tool or as an "a priori" approach in the basin analysis ;
 - (4) More effort should be done in order to further understand the origin of some Jurassic unconformities and flooding events which have a very large geographical extend. The "local" knowledge of the individual components of the Jurassic researchers should be agglutinated to reach more light on this question.

-

O. MICHELSEN, ARHUS, 21st MARCH 1994

Even though I has earlier responded on the matter of sequence stratigraphy, I will shortly answer your letter dated 13.01.94, because I am not sure which opinion is referred in that letter.

Problems mentioned in my former letter (July 1st 1993) are still important, and I also agree on the text in your letter (referring to who?). To neglect sequence stratigraphy (POULTON's answer?) is not realistic. In my opinion, sequence stratigraphic tool for basin analysis (*s.l.*), both on the surface and in subsurface geology.

The sequences seem to have chronostratigraphic significances, but that does not make them identical with chronostratigraphic units, which have to be global. That is an important point in the discussion with persons who believe that eustatic sea-level changes are the overall controlling factor. The sequence stratigraphic analysis within one basin makes it possible to establish a stratigraphic scheme with a more detailed resolution than that of the controlling biostratigraphy. Correlation of such schemes between basins can not be based on the sequence stratigraphic concept (as believed by some persons), but has to include e.g. biostratigraphy. The dominans of eustatic sea-level changes in relation to local factors (subsidence, sediment influx etc.) has not yet been proved, and a global correlation of sequences is therefore dangerous without support from biostratigraphy, magnetostratigraphy etc. However, some persons believe the eustatic sea-level changes to be the controlling factor of sequences. They number the cycle boundaries in accordance with numerical ages, which is in my opinion very dangerous for any stratigraphic conclusion. A correlation with the HAQ *et al.* eustatic sea-level curve on the basis of sequence stratigraphic concept seems to me to be arguing in a circle, and to establish a "sequence chronostratigraphy" is a dangerous way of thinking.

Sequence stratigraphic analysis strongly integrated with e.g. biostratigraphy and magnetostratigraphy is a powerful stratigraphic tool, which certainly will stay in geology for many years. I therefore recommend that ICS include sequence stratigraphy in the stratigraphic classification as independent of the existing disciplines.

I hope you will get more answers this time because it is an important matter.

-

D. TAYLOR, PORTLAND, MARCH 22, 1994

Regarding Sequence Stratigraphy – This approach to undertaking stratigraphic problems is a fruitful and interesting one addressing local, regional and global factors in sequence developments. Furthermore, new terminology should and does arise to assist in clear, concise description of concepts in sequence stratigraphy.

Nevertheless, I believe that a stratigraphic code overly encumbered with terminology loses its flexibility and diminishes rather than enhances our ability to work effectively with complex problems in nature. In this spirit, I recommend addressing sequence stratigraphy in code issues, with the stipulation that we should work within the framework of established stratigraphic codes and with minimal alteration to them.

I hope these comments are of some help. Please let me know if you have any questions.

-

J. KUTEK, WARSZAWA, 22 MARCH 1994

"Genetic stratigraphic units (sequences) are worth being separated out as distinct stratigraphic units. Furthermore, there appears the fascinating problem whether isochro-

nous events, eustatic or (rather) tectonic in nature, make it possible to recognize isochronous sequences on a supraregional or global scale. Better evidence for the reality of synchronism of significant geological events can be provided by continental stratigraphy, because of stratigraphic resolution often at the level of a subzone or horizon, than by seismostratigraphy in marine domains.

Nevertheless, I am not convinced that an appropriate project could be co-ordinated (and sponsored ?) efficiently by the Subcommittee on Jurassic Stratigraphy. More generally, as genetic stratigraphic units should be interpreted in the framework of regional tectonics, I am afraid that a project concentrated on stratigraphic aspects of what would be called sequences may easily degenerate into correlating anything with anything (i.e. into correlations of meaningless events, not genetically related".

—

J. H. CALLOMON, LONDON, 24 MARCH 1994

Sequence Stratigraphy

Sequence stratigraphy goes back to the tripartite sequences recognized in the English Jurassic by John PHILLIPS more than a hundred years ago. It has been used by sedimentologists in one way or another for at least fifty years. In each case, it is concerned with local processes. It is symptomatic of the ICS's submission that it seems to allude to the currently fashionable gospel of VAIL Sequence Stratigraphy, which is also based on a model of local processes, no matter how much its esoteric nomenclature may obscure this point. Its greater claims to universality in terms of eustasy are at best conjectural, controversial and wholly unsubstantiated. All good and fine, but no business of the ICS. An International Commission of Sedimentology, or Basin Analysis, perhaps ; and a chapter in an International Guide to Stratigraphy explaining what it really is and giving us translations of all the technical jargon it has generated, yes please. But no voting or more Notes of Guidance on what To Do, please.

—

G. PAVIA, TORINO, 29 MARCH 1994

Sequence Stratigraphy - I agree the comments sent to and reported by the ICS ; it is necessary to pay attention in going too deeply into modelling and worldward correlating events which could be controlled by local and/or regional factors. It is also necessary to better study and define what are called as "condensed sections" (chrono-correlation horizons through the basin) as they could depend either on stratigraphic (condensed successions), sedimentary (condensed sediments) or taphonomic condensation (condensed fossil assemblages) ; their meaning and correlation value are quite different.

—

A. ZEISS, ERLANGEN, 10. APRIL 1994

Concerning the problem of "Sequence Stratigraphy" I personally favour the first comment. But the problem was not discussed in the working group until now, explicitly.

Sequence stratigraphy is certainly one of the most interesting new concepts and will lead to a better understanding of the changes in the sedimentary evolution of basins as well as of the changes in faunal composition, immigration and provincialism. I only doubt a bit the chronostratigraphic meaning because this depends always of an independent biostratigraphic dating of the sequence boundaries.

Perhaps there is opportunity to discuss the matter during the next Symposium in Mendoza.

-

P. TCHOUMATCHENCO, SOFIA, 22 APRIL 1994

In Bulgaria we have not experience in the field of the sequence stratigraphy, not only in the Jurassic, but also in the stratigraphy of the others systems. The two opinions, cited in your 13/01/1994 letter exprimed to two possible ways of the development of the sequence stratigraphy. I would like to support the first one – that it is necessary to make essay to work out some good outcropped sections through the Jurassic in different localities, and to obtain new material for comparision and in result of these studies to decide if the sequence stratigraphy is “a temporary fashion in geology” or it is “the most important method in basin analysis”. I can not understand why the eustatic cycles of the Jurassic are based on the diagram of HAQ *et al.* absolutly age, which is an old one. It exists in the literature more recent scale of the absolutly age – for example this of G.-S. & C. ODIN. I think that it is necessary for the Jurassic to choose a more modern scale for the absolut age of the rocks, and to compare the results of the sequence stratigraphy on this base.

.....

4. ACTIVITIES OF THE BUREAU OF THE ISJS



- As you may have read in the last list we sent (ref. RE/NP. 61/94) the ISJS integrated the Trias /Jurassic Boundary WG (formerly Hettangian WG), the Jurassic/Cretaceous Boundary WG. being integrated in the Cretaceous Subcommittee.
- Neither formal structure nor formal procedure of voting are defined concerning the working groups, except Inter System Boundary Working Groups such as the Triassic/Jurassic Boundary WG. See also p. 7 the opinion recently received from the ICS Chairman.

4.2 - VOTES ON PROPOSALS OF THE ICS

- On the activation of a "Committee on the Lexicon of Stratigraphy" whose objective will be to examine whether the lexicon can be revitalized as a global Lithostratigraphic (computer) Data Base (...).

The Chairman's vote was : **YES**.

- On the establishment of a "Committee on Genetic Stratigraphy". See in this *Newsletter* issue, p. 57.

The Chairman's vote was : **YES**.

- On reorganization of the International Subcommittee on Stratigraphic Classification. The proposal of the Bureau of the ICS is to reorganize the ISSC in a Committee "due to its limited work scope in the foreseeable future".

The ISSC has recently completed a revision of the International Guide to Stratigraphic Classification (see *Newsletter* n° 21) and is finishing now a short version of the Revised Guide.

The two other prospects presented by the ISSC were Sequence Stratigraphy for which a Committee *ad hoc* was established by the ICS and Revised Guidelines for the Establishment of GSSP which have been undertaken by the Bureau of the ICS.

The Chairman's vote was : **YES**.

- On dissolution of the Subcommittee on Gondwana Stratigraphy since its activities do not fit the mission of ICS.

The Chairman's vote was : **YES**.

4.3 - MISCELLANEOUS

We recall here some documents attached to the letter we sent you July 4, 1994 :

- Publication, by ICS bodies.

- Participation of ICS Subcommittee in IGCP Programs. We did not receive any comment. After a survey of the attached IGCP Programs list, it seems that members of the ISJS or/and Jurassic workers are involved in at least 3 programs :

- 306 : Stratigraphic Correlation of Southeast Asia, in which appears Prof. DANG Vu Khuc, a Corresponding Member of the ISJS.
- 322 : Correlation of Jurassic Events in South America, the leader of which is Dr. A.C. RICCARDI, a Voting Member of the ISJS.
- 343 : Stratigraphic analysis of Peritethyan Basins, for which the chairman was asked to review some projects involving Jurassic workers or/and members of the ISJS.

A fourth IGCP Program is missing which also involves Jurassic workers or/and members of the ISJS.

- 171 - Circum Pacific Jurassic (Leader G.E.G. WESTERMANN) whose the main outcomes of the research are the publication listed below :

WESTERMANN, G.E.G. and RICCARDI, A.C. (eds), 1988. Jurassic Taxa Ranges and Correlation charts for the Circum Pacific. 1 - Soviet Union ; 2- China (People's Rep.). *Newsl. Stratigr.*, 19(1/2) : 1-130, 1988. 3 - South America and Antarctic Peninsula. *Newsl. Stratigr.* 21(2) : 81-108, 1991.

Next issues will be :

- 5- Australasia
- 6- North America.

WESTERMANN, G.E.G. (ed.) 1992. *The Jurassic of the Circum Pacific*, Cambridge, Univ. Press, 676 pp.

Please, confirm or eventually add other IGCP Programs and give the name of Jurassic workers being involved.

- Questionnaire on Future Objectives and Achievements of ICS Constituent Bodies. The question has been dealt with before (see p. 6) : no responses in time and the Bureau answered the questionnaire according to her's light !
- Symposium on multidisciplinary stratigraphy at the 30th IGC at Beijing. I recall 1) we were asked to present concrete proposals (...) indicating the Subject of the presentation, with a short explanation of its content (a kind of mini-abstract) and 2) the comments by the ICS Chairman about the Symposium :

"On this symposium each ICS body is to present an overlook over its work, which is accessible to a larger audience. The image of stratigraphy and stratigraphers is not too good for the time being. This is also reflected by diminishing funding for ICS. The planned symposium shall therefore highlight the achievements realized so far (GSSPs) and in the same time give an idea of the various methods employed to attain our main goal, i.e. to establish a global geochronologic standard scale (multidisciplinary stratigraphy). Obviously, methods will vary from one part of the stratigraphic column to the other. On the other hand, specific problems and difficulties should be exposed in order to show that there are also objective problems (which are often not obvious for the non-stratigrapher).

The title of the symposium will be changed in order to correspond to the objectives outlined above".

♦♦♦♦

**5. REVISION OF THE LISTS OF
THE MEMBERS OF THE ISJS
AND WG CONVENORS**



5 - REVISION OF THE LISTS OF THE MEMBERS OF THE ISJS AND WG CONVENORS

Some changes are needed for various reasons.

5.1 - CONCERNING MEMBERSHIP OF THE ISJS

Under the art. 8.1. (Terms of office) of the Statutes of the ICS, "at the end of each term (e.g. period between two IGC normally 4 years) one third (1/3) of the Voting Members shall be replaced by new Voting Members".

During the last years too much members, either Voting or Corresponding, did not answer letter and inquiries or did not give any indication for being really active. Sometimes the letters are returned undelivered, whether the colleague is presently retired or changed his office without any indication of the new adress !

The Bureau wrote to all the members concerned asking them to confirm retirement as member of the ISJS or membership giving the assurance they will fulfill their duty.

According to the answers, we shall discuss new memberships, during the Mendoza session.

5.2 - CONCERNING WG CONVENORS

Aalenian WG - By common consent , S. CRESTA (Servizio Geologico d'Italia) replaced A. GOY. S. CRESTA prepared with G. PAVIA the report on the joint meeting of the Aalenian and Bajocian WG in Marrakech.

Bajocian WG - In the same way, A GALACZ (Eötvös Univ., Budapest, Hungary) will replace G. PAVIA (Univ. Torino, Italia).

Callovian WG - J.H. CALLOMON (Univ. College, London) wrote to the chairman he has now formally retired which implies that "what limited support there had been in the part in facilities and travel grants will be strongly curtailed". So he feels that the time has come for someone else to take over the Callovian WG... unless the proposal he intends to prescit in the coming year would to be finally ratified...

Pliensbachian WG. After numerous claims concerning the WG activities, R. SCHLATTER answers recently "... coordinating the activities of the Pliensbachian WG, become to be impossible; Therefore I suggest to induce a new coordinator".

.....

6. ENCLOSURE STATUTES OF THE ICS





11.19.1993

**STATUTES
OF THE
INTERNATIONAL COMMISSION ON STRATIGRAPHY**

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1. DEFINITIONS

The International Commission on Stratigraphy is a Commission established by the International Union of Geological Sciences. The Commission is hereinafter referred to as ICS and the Union as IUGS. The executive body of ICS is named the Bureau. The Full Commission of ICS is the quorum formed by the officers of the Bureau and the Chairpersons of each of the Subcommissions. They are the Voting Members of the Commission. The International Geological Congress, hereinafter referred to as IGC, is a conference of earth scientists normally held every four (4) years.

2. PURPOSE AND OBJECTIVES

ICS is a body of expert stratigraphers founded for the purpose of promoting and coordinating long-term international cooperation and establishing standards in stratigraphy. Its principal objectives are:

- (a) the establishment and publication of a standard global chronostratigraphic scale and the preparation and publication of global correlation charts, with explanatory notes,
- (b) the unification of lithostratigraphic nomenclature by organizing and documenting lithostratigraphic units on a global data base, with periodic updates,
- (c) the scrutiny of new stratigraphic methods and their integration into a multidisciplinary stratigraphy, and
- (d) the definition of principles of stratigraphic classification, terminology and procedure and their publication in glossaries, with periodic revisions.

The scientific activities shall be carried out through projects or meetings arranged in collaboration with IUGS-affiliated organizations, IUGS-joint programs, non-governmental bodies and inter-governmental bodies.

3. ICS ORGANIZATION AND VOTING

ICS is managed by the Bureau which consists of elected and appointed officers. ICS is organized into two types of constituent bodies, Subcommissions and Committees, with their own executives and members. Subcommissions are bodies created for the long-term study of specific aspects of stratigraphy. Committees are bodies created for limited or short-term stratigraphic tasks. The Full Commission makes all formal decisions of ICS. Chairperson of the Full Commission is the Chairperson of ICS.

The members of the Full Commission make their decisions by vote. All decisions, including elections, require a sixty percent (60%) majority vote for approval. Such votes are conducted by postal ballot, giving a deadline of sixty (60) calendar days for the receipt of the votes. Voting Members may vote "yes," "no" or "abstain." Non-responses are counted as approval votes. The Chairperson of an ICS Committee is not a Voting Member.

4. ICS BUREAU AND OFFICERS

The officers of the ICS Bureau shall be the Chairperson, two (2) Vice Chairpersons, the Secretary and the Past Chairperson, or the Past Secretary if the Past Chairperson is unable or unwilling to serve. All officers serve in an individual capacity. The other officers shall serve as advisors to the Chairperson and assist him/her in the performance of his/her duties.

4.1 Chairperson

The Chairperson shall be the chief executive officer of ICS. He/she shall manage its activities and set scientific goals for the individual Subcommissions and Committees within the scope of the authority delegated to him/her by IUGS. He/she shall solicit the advice of the Full Commission, when necessary, for the administration of ICS and consult with it on matters of major policy and scientific programs either by correspondence or by meetings.

4.2 Vice Chairpersons

The First Vice Chairperson shall serve as Chairperson for the remainder of the term of office when the position of Chairperson should become vacant.

The Second Vice Chairperson shall coordinate the work of ICS with the Preparatory Committee of the next IGC. He/she is appointed by that Committee.

4.3 Secretary

The Secretary shall assist the Chairperson in his/her administrative and scientific work. He/she shall record the minutes of meetings of the ICS Bureau and of the Full Commission and keep the financial accounts of ICS. He/she organizes the votes within the Full Commission.

4.4 Past Chairperson

The Past Chairperson, or Past Secretary, shall serve as an ex-officio member of the Bureau.

5. ICS SUBCOMMISSIONS

5.1 Composition of Subcommissions

Each Subcommission shall be managed by an executive body consisting of a Chairperson, at least one Vice Chairperson and a Secretary.

Subcommissions shall be made up of between ten (10) to twenty (20) Voting Members, including their officers. They shall represent regional and methodological diversity in an appropriate manner. Membership may be terminated if a Voting Member fails to participate in the work of the Subcommission and does not respond to communications from its Chairperson.

Subcommissions may appoint a reasonable number of Corresponding Members for the advice of Voting Members in achieving the assigned scientific tasks.

5.2 Officers

The Chairperson shall be the chief executive officer of the Subcommission. He/she is responsible for the execution of agreed scientific goals and the preparation and the contents of annual scientific and financial reports of the Subcommission. In consultation with the Voting Members of the Subcommission, he/she establishes work plans and operating budget requests for the following year. The Vice Chairperson shall serve as Chairperson when the position of Chairperson should become vacant. The Secretary assists the Chairperson in his/her scientific and administrative duties and is responsible for the organization of votes within the Subcommission.

5.3 Intersystem Boundary Working Groups

Subcommissions which are responsible for one of the systems of the geochronologic scale shall have an Intersystem Boundary Working Group for definition of the lower boundary of that system, if no boundary-stratotype has yet been defined.

Each Intersystem Boundary Work Group shall have a Chairperson, a Vice Chairperson and a Secretary. The Chairperson of the Intersystem Boundary Working Group shall be a Voting Member of the respective Subcommission and report to its Chairperson.

Intersystem Boundary Working Groups shall be made up of ten (10) to twenty (20) Voting Members, including its officers, and shall represent regional and methodological diversity in an appropriate manner. Membership may be terminated if a Voting Member fails to participate in the work of the Working Group and does not respond to communications from its Chairperson.

Intersystem Boundary Work Groups may appoint a reasonable number of Corresponding Members if they require their advice in achieving the assigned scientific task.

5.4 Other Bodies

Subcommissions may appoint such working groups, regional committees or other ad hoc groups which they consider necessary to fulfill their scientific tasks. These bodies report to the Chairperson of the respective Subcommission.

6. ICS COMMITTEES

The Committees report directly to the ICS Bureau. The organization of Committees is related to their scientific tasks and is subject to approval by the ICS Chairperson.

7. ESTABLISHMENT AND DISSOLUTION OF ICS CONSTITUENT BODIES

7.1 Subcommissions

New Subcommissions shall be established by the IUGS Council when the Full Commission of ICS is convinced of the necessity and makes a recommendation for the establishment of a new ICS Subcommission to the IUGS Council. When approved by the IUGS Council, the IUGS Executive

Committee shall appoint a temporary Chairperson, Vice Chairperson and Secretary and the other initial members of the new Subcommittee, following the proposal by the Full Commission of ICS. To develop this proposal, the Full Commission of ICS shall select the initial members and temporary officers from a recommendation made by the ICS Chairperson. For subsequent terms of office, elections shall be held within the Subcommittee by a quorum of Voting Members.

The dissolution of Subcommissions requires the consent of the IUGS Council.

In case of geochronologically oriented Subcommissions, a new Intersystem Boundary Working Group may be appointed if there is a strong demand to replace an existing boundary-stratotype with or without notable change of the boundary level. If at least sixty percent (60%) of the Voting Members of the Subcommissions responsible for the system above and below the boundary and of the Commission vote in favor of undertaking a boundary revision, a new Intersystem Boundary Working Group shall be established, which may then propose a new boundary-stratotype or confirm the old.

At the demand of the Chairperson of the Subcommittee to which the Intersystem Boundary Working Groups reports, and with the approval of the Chairperson of ICS, an existing Intersystem Boundary Working Group may be reorganized to continue with new officers and members.

In both cases, the following procedure, conducted by the Chairperson of the Subcommittee to which the Intersystem Boundary Work Group reports, shall be followed:

- (a) A list of candidates for Voting Membership in the new Working Group is established based on nominations from Voting Members of the Subcommissions dealing with the systems above and below the boundary. Nominees may, in part, be Voting Members of the old Working Group; they need not be Voting Members of one of the Subcommissions.
- (b) From these nominees, the Voting Members of the Subcommittee responsible for the system above the boundary shall elect between ten (10) and twenty (20) Voting Members of the new Working Group.
- (c) The new Voting Members shall subsequently elect the officers of the new Working Group.

Intersystem Boundary Work Groups are automatically dissolved once they have fulfilled their objective.

7.2 Committees

New Committees may be established by decision of the Full Commission. The initial members and temporary officers of the new Committee shall be appointed by the Chairperson of ICS after consultation with the other Bureau members and after opportunity for suggestions has been given to Subcommissions of ICS. For subsequent terms of office, the Committee shall elect its officers by a quorum of Voting Members.

Committees may be dissolved, reorganized or regrouped with other ICS bodies by decision of the Full Commission.

8. ELECTIONS

8.1 Terms of Office

The term of office for the Voting Members of the Full Commission, of Subcommissions and their constituent bodies, and of Committees shall be the period between two IGCs, normally four (4) years. The Chairperson, including his/her selected Secretary, and the First Vice Chairperson of ICS and Chairpersons of Subcommissions, including Intersystem Boundary Working Groups, and of Committees shall be reelectable only for one more four-year term after their election for the initial term of office.

Voting Members of Subcommissions, including Intersystem Boundary Work Groups, and of Committees shall be reelectable for two more four-year terms after their election for the initial term of office. At the end of each term one-third (1/3) of the Voting Members shall be replaced by new Voting Members. In case of extraordinary organizational or scientific circumstances, Voting Membership may be extended after approval has been obtained from the ICS Chairperson.

8.2 Nominating Committee

The Nominating Committee is the body elected by the Full Commission for proposing candidates for the election of the Chairperson of ICS, including his/her selected candidate for Secretary, and the First Vice Chairperson of ICS. The Committee shall consist of five (5) members. The Chairperson of the Nominating Committee shall be appointed by the ICS Chairperson.

A slate of candidates for the Nominating Committee, having declared that they are willing to serve, shall be prepared by the ICS Chairperson, starting at least twenty-four (24) months prior to the next IGC. At the same time, all Voting Members of the Commission can propose additional candidates for the Nominating Committee to the ICS Chairperson. This slate shall be submitted to the Voting Members of the Commission for election not later than twenty-one (21) months prior to the next IGC. The same voting stipulations apply as for the election of ICS officers.

8.3 Nomination of Officers of the ICS Bureau

The Nominating Committee shall invite proposals of candidates for the positions of Chairperson and First Vice Chairperson of the Bureau from all Subcommissions of ICS, but the Committee shall not be restricted thereby in its choice of candidates.

The Nominating Committee shall evaluate the merits of all proposed candidates for each position, taking into consideration their scientific qualification, managerial capability and willingness to serve. The Committee shall nominate to the ICS Chairperson one candidate for each of the two positions no later than eighteen (18) months prior to the next IGC, bearing in mind geographical and disciplinary diversity.

Upon receipt of the Nominating Committee's submission, the Chairperson of ICS shall promptly circulate the proposal of nominated candidates to all the Voting Members of the Commission. If Voting Members disagree with any of the selected candidates, they may propose, in addition, their own candidate(s) to the Chairperson of ICS and of the Nominating Committee, provided that twenty-five percent (25%) of the Voting Members of the Commission are in support of such proposal, that the Chairperson of ICS and of the Nominating Committee has received such proposal no later than fourteen (14) months prior to the next IGC and that these candidates fulfill the same qualifications as required from the candidates proposed by the Nominating Committee.

8.4 Nomination of Chairpersons of Subcommissions

Each Subcommission of ICS shall propose to the ICS Chairperson one or two qualified candidates who are willing to serve as Chairperson.

8.5 Election Procedure

In case of a single candidate, the officers of the ICS Bureau and the Chairpersons of ICS Subcommissions are elected by a sixty percent (60%) majority and non-responses to ballots shall be counted as approval votes. In case of more than one candidate, a relative majority will suffice for election.

8.5.1 ICS Bureau

No later than twelve (12) months prior to the next IGC, the Chairperson of the Nominating Committee shall mail to all Voting Members of the Commission a ballot containing:

- (a) the name(s) of the candidate(s) for Chairperson, together with the name of his/her selected Secretary,
- (b) the name(s) of the candidate(s) for First Vice Chairperson.

A short curriculum vitae of all candidates shall be attached. A deadline of sixty (60) calendar days shall be given for the return of the ballots.

The election requires approval by the IUGS Executive Committee and ratification by the IUGS Council.

8.5.2 Chairpersons of ICS Subcommission

Chairpersons of Subcommissions of ICS shall be elected by the Voting Members of the Commission by ballot to be mailed by the ICS Secretary not later than twelve (12) months prior to the next IGC.

8.5.3 Others

Voting Members of Subcommissions and bodies reporting to Subcommissions, including Intersystem Boundary Working Groups and their Chairpersons, and Chairpersons and Voting Members of Committees shall be elected by the Voting Members of the respective bodies at the time of election of Chairpersons of Subcommissions. Voting Members of an Intersystem Boundary Working Group are confirmed by the Chairperson of the Subcommission to which it reports. The election of Voting Members of Subcommissions, including Chairpersons of Intersystem Boundary Working Groups, and of Chairpersons and Voting Members of Committees is subject to approval by the ICS Chairperson.

9. MEETINGS

The Bureau shall meet at the request of the Chairperson or of any two other officers of the Bureau.

The Full Commission shall meet regularly during the IGC. Additional meetings of the Full Commission may be called by the Chairperson of ICS with the advice of the ICS Bureau.

Subcommissions, Intersystem Boundary Working Groups, and Committees shall endeavor to hold at least one meeting during each IGC. They are encouraged to organize additional meetings during major international conferences on their field of scientific expertise.

10. ANNUAL REPORTS

10.1 Subcommissions and Committees

The Chairpersons of ICS Subcommissions and Committees shall transmit annual reports to the Chairperson and the Secretary of ICS no later than the first of November of each year. The annual reports shall include an overview of the scientific activities and achievements, together with the statement of operating accounts, for the current year and work plans and anticipated achievements, with the operating budget request, for the following year. In the case of Subcommissions with constituent bodies, these Subcommissions' reports shall include the scientific achievements and plans of these bodies.

Intersystem Boundary Working Groups shall prepare annual reports to the Chairpersons of the Subcommissions dealing with the systems above and below the studied boundary. The Subcommission responsible for the system above the studied boundary shall include this information in its report. It is also responsible for including the Working Group's operating costs in that Subcommission's budget.

10.2 Full Commission

The Chairperson of ICS shall submit a consolidated annual report on behalf of ICS to the IUGS Executive Committee at the time stipulated by that Committee. The ICS report shall contain the reports of the individual Subcommissions and Committees and shall, in addition:

- (a) highlight the scientific achievements of these constituent ICS bodies,
- (b) communicate all formal decisions taken by the Full Commission of ICS,
- (c) report on administrative matters of ICS,
- (d) provide a consolidated statement of ICS' operating accounts for the current year, and
- (e) submit the work plans and recommend a consolidated operating budget request of ICS for the following year.

11. ENTRY INTO FORCE AND AMENDMENTS TO STATUTES

These Statutes shall come into force as soon as they have been approved by the Full Commission and by the IUGS Council.

These Statutes were approved by a _____ percent (____%) majority vote of the Full Commission effective _____ and ratified by the IUGS Council on _____.

These Statutes supersede the Statutes issued on June 16, 1986.

These Statutes may be amended by an approval vote of the Full Commission, subject to ratification by the IUGS Council.

	Age	submission date	publication date		stratotype
			not published yet	published yet	
1	base Cambrian	4.11.91			Fortune Head, SE Newfoundland, Canada
2	base Silurian / Llandovery / Rhuddanian	feb. 1985	Episodes, vol. 8, n° 2, 1985		Dob's Linn, Moffat, Scotland, GB
3	base Aeronian	feb. 1985	Episodes, vol. 8, n° 2, 1985		Cefn Coed-Aeron Farm, Wales, GB
4	base Telychian	feb. 1985	Episodes, vol. 8, n° 2, 1985		Cefn Cerig section, Wales, GB
5	base Wenlock / Sheinwoodian	feb. 1985	Episodes, vol. 8, n° 2, 1985		Hughley Brook, Wales, GB
6	base Homerian	feb. 1985	Episodes, vol. 8, n° 2, 1985		Whitwell Coppice, Wales, GB
7	base Ludlow / Gorslian	feb. 1985	Episodes, vol. 8, n° 2, 1985		Pitch Coppice, Wales, GB
8	base Ludfordian	feb. 1985	Episodes, vol. 8, n° 2, 1985		Sunnyhill Quarry, Wales, GB
9	base Pridoli	feb. 1985	Episodes, vol. 8, n° 2, 1985		Pozary section, Barrandean, Czech Rep.
10	base lower Devonian / Lochkovian	1972	A. Martinsson ed. (1977): The Silurian-Devonian boundary. IUGS, Ser. A, Nr. 5		Klonk, Barrandean, Czech Rep.
11	base Pragian	31.12.88	Episodes, vol. 12, n° 2, 1989		Praha Holyne, Barrandean, Czech Rep.
12	base Emsian	(to be voted)	not published yet		Zinzilban Gorge, Uzbekistan
13	base Middle Devonian / Eifelian	feb. 1985	Episodes, n° 4, 1982 & Episodes, vol. 8, n° 2, 1985		Wetteeldorf, Eifel, Germany
14	base Givetian	15.3.93	not published yet		Jebel Mech Irdane, Morocco
15	base Upper Devonian / Frasnian	3.9.86	Episodes, vol. 10, n° 2, 1987		Col du Puech de la Suque, Montagne Noire, F
16	base Famennian	feb. 1985	Episodes, vol. 8, n° 2, 1985		Courmiac, Montagne Noire, France
17	base Carboniferous	1.9.88	Episodes, vol. 10, n° 2, 1991		La Serre, Montagne Noire, France
18	base Paleogene / Paleocene / Danian	5.6.90	not published yet		El Kef, Tunisia
19	base Oligocene	30.11.91	Episodes, vol. 16, n° 3, 1993		Massignano, Italy
20	base Pleistocene	feb. 1985	Episodes, vol. 8, n° 2, 1985		Vrica, Italy

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Appendix II

RHAETIAN		HETTANGIAN	
<p>ARCTIC PROVINCE (NE former USSR; Region in Koyabols et al., 1988)</p>	<p>?</p>	<p><i>Ps. planorbis</i> <i>Ps. vilgense</i> <i>Ps. suberogatum</i> <i>Ps. plicatulum</i></p> <p>Planorbis Zone</p>	<p><i>Ps. primulum</i></p> <p>Planorbis Zone</p>
<p>ATHABASCAN PROVINCE (Nevada, USA; Guex 1980, 1982)</p>	<p><i>Cu. jenerum</i> <i>Tr. transiens</i> <i>Ps. polymorphum</i> <i>Ne. compressus</i></p>	<p><i>Ps. aff. acense</i> <i>Ne. compressus</i></p> <p><i>Ps. pacificum</i> <i>Ne. compressus</i></p>	<p><i>Ps. sp.</i></p> <p><i>Ch. crickmayi</i> <i>Ps. sp.</i> <i>?Ps. sp. nov.</i> ?</p> <p>Tamocum Zone Crickmayi Zone</p>
<p>ANDEAN PROVINCE (Chile, Peru; Hillebrandt, 1987, 1988, 1990)</p>	<p><i>'Cu'. peruvianum</i> <i>Cu. cf. subangulare</i> <i>Cu. ornament</i></p> <p><i>Di. sp. nov. aff. retzi</i></p> <p><i>Ps. rectocostatum</i></p> <p><i>Ps. aff. pifionotum</i></p> <p><i>Ps. primocostatum</i></p> <p><i>Ps. tilmanni</i></p>	<p><i>Ps. rectocostatum</i></p> <p><i>Ps. aff. pifionotum</i></p> <p><i>Ps. primocostatum</i></p> <p><i>Ps. tilmanni</i></p>	<p>?</p> <p><i>Ch. cf. marzhi</i> <i>Ch. cf. crickmayi</i> <i>Ch. cf. noble</i></p> <p>cf. Noxi Zone cf. Marzhi Zone Cric Zone</p>
<p>NORTH WEST EUROPEAN PROVINCE (West Somerset, UK; pers. obs.)</p>	<p><i>'Wa'. prometheus</i></p> <p><i>Ca. intermedium</i></p> <p><i>Ca. johnstoni</i></p> <p><i>Ca. sp. (or sp.) 1</i></p> <p><i>Ps. plicatulum</i> <i>Ps. brittoniense</i></p> <p><i>Ps. samoaal</i> <i>Ps. cf. primocostatum</i></p> <p><i>Ps. sp. cf. planorbis</i> (hand Np. sp.?)</p> <p><i>Ps. sp. cf. planorbis</i> and/or Np. sp.</p>	<p><i>Ps. plicatulum</i> <i>Ps. brittoniense</i></p> <p><i>Ps. samoaal</i> <i>Ps. cf. primocostatum</i></p> <p><i>Ps. sp. cf. planorbis</i> (hand Np. sp.?)</p> <p><i>Ps. sp. cf. planorbis</i> and/or Np. sp.</p>	<p>?</p>
<p>NORTH WEST EUROPEAN PROVINCE (Ardèche, France; Eloit and Mouterele, 1965)</p>	<p><i>'Wa'. gr. megastomum</i> <i>Johnstonianum</i></p> <p><i>Ca. belcheri</i></p> <p><i>Ca. johnstoni</i></p> <p><i>Ps. plicatulum</i></p> <p><i>Ps. psilonotum</i></p>	<p><i>Ps. plicatulum</i></p> <p><i>Ps. psilonotum</i></p>	<p>?</p>
<p>NORTH WEST EUROPEAN PROVINCE (Germany; Lange 1941; Bloos, 1985a, b)</p>	<p><i>Ca. torus</i> <i>Cu. sp.</i></p> <p>?</p> <p>?</p> <p><i>Ps. plicatulum</i></p> <p><i>Ps. psilonotum</i> <i>Np. anicredens</i></p>	<p><i>Ps. plicatulum</i></p> <p><i>Ps. psilonotum</i> <i>Np. anicredens</i></p>	<p>?</p>
<p>MEDITERRANEAN PROVINCE (Austria; Krysryn, 1973; Wiedman et al. 1979; Lange 1952; Blind, 1963; Bloos, 1985b)</p>	<p><i>Cu. incertum</i></p> <p>?</p> <p><i>Ps. calliphylum</i></p> <p><i>Ps. psilonotum</i></p>	<p><i>Ps. calliphylum</i></p> <p><i>Ps. psilonotum</i></p>	<p>?</p> <p><i>Ch. marzhi</i></p> <p><i>Va. surrettenbuhl</i> <i>Ec. sp.</i>, <i>Ch. marzhi</i> <i>Rh. jurezi</i></p> <p><i>So. reticulatus</i> <i>Co. sp.</i>, <i>Ch. marzhi</i>, <i>Rh. jurezi</i></p> <p>Suess Zone Reti Zone Suer Zone Marzhi Subzone Calliphylum Zone</p>

