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- Cephalopoda, Early Hettangian in the New York Canyon sections (Gabbs Valley Range, Nevada) and discussion of the ^{13}C negative anomalies located around the Triassic-Jurassic boundary. *Bulletin de la Société Vaudoise des Sciences naturelles*, 88/2: 247–255.
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SOME COMMENTS ON THE PROPOSALS FOR THE GSSP OF THE KIMMERIDGIAN STAGE

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I fear there may be some confusion in the debate on this subject, arising as usual from the conflicting objectives set in the ICS *Guidelines*. As I see it, there are two questions to be considered at the outset, relating to the choice of procedure:

A. Do we want to define a universal, "Global" Kimmeridgian Stage Boundary in a type section (GSSP) as called for in the *Guidelines*, irrespective of the current standard chronostratigraphical units of lower rank that this Stage contains, i.e. its Standard Zones and Subzones? If so, on what grounds?

Or,

B. Following the hierarchical principle, re-explained over the years now so many times, do we want to define a Primary Standard Chronostratigraphical Kimmeridgian Stage in terms of the lower boundary time-plane in the type section (PSSP) of its lowest Zone or Subzone? If so, there are some additional principles that will have to be considered. They follow the rules of *stratigraphical taxonomy* arising from the hierarchical principle and hence, separately, the rules of *stratigraphical nomenclature* that follow from the attempt to avoid ambiguity on grounds of homonymy [e.g. 'Kimmeridgian s.s.' and 'Kimmeridgian s.l., *sensu popolare*], synonymy [see e.g. Arkell's list of 'Stages' in his *Jurassic System in Great Britain* (1933)] and priority. (Does this sound familiar?).

Primary and secondary standards

(1) Taxonomy: primary standard. There is only one *primary* standard Kimmeridgian Stage, clearly defined in terms of its contained Zones by Salfeld (1913): his Baylei - Cymodoce - Mutabilis - Yo - Pseudomutabilis Zones. This, brought up to date, is what today we call the *Subboreal* zonation. The lower boundary of the Kimmeridgian Stage is therefore that of the Baylei Zone. The Primary Stage Section and Point (PSSP) is therefore that of the Baylei Zone. (We will leave aside for the moment the question of the upper limit of the Kimmeridgian Stage: the age-old problem of Kimmeridgian *sensu anglico*, ranging up to the base of the Portlandian, and Kimmeridgian *sensu gallico* ranging up to the base of the Tithonian. It will be considered briefly further below).

[*Comments:* The use of the concept and word 'Zones' is here unambiguously in the Opeian, standard chronostratigraphical, hierarchical sense, as opposed to so many other 'zones' in the literature, particularly German, used in a merely biostratigraphical sense. Re-reading Salfeld, nothing could be clearer. "The Kimmeridgian ... would comprise (*sic*) the following zones, taken in ascending order: ... ". There is a clear distinction between Kimmeridgian Stage and Kimmeridge Clay Formation. There is no "classic d'Orbigny's Oxfordian/Kimmeridgian boundary" in any modern chronostratigraphical sense. And although the ICS has not seen fit to define any rules of stratigraphical nomenclature, so that there formally exists no "law of priority", all who have attempted to codify modern zonations have tried to follow, consciously or unconsciously, Arkell's *Code* of 1946 and to identify earliest use, i.e. priority, in a recognizably chronostratigraphic sense (at least, in the Jurassic they have)].

(2) Submediterranean secondary standard. The Subboreal primary standard Kimmeridgian zonation cannot be "applied" (in the words of the ICS) in the Submediterranean Province (even less the Big G: "globally") - on which we are all agreed. There has therefore been constructed an independent, parallel zonation, of finesse and geographical applicability at least as good as the primary Subboreal standard: a *Submediterranean, secondary standard* Stage.

[*Comments:* another familiar procedure, as previously applied to the age-old problem of the Tithonian-

Portlandian-Volgian trinity, which is as practically necessary and useful today as it was in the past; and which too is under continuing pressure to sweep the real problems under the carpet and to impose the primary standard, the Tithonian, on successions in which it cannot be recognized - at least, with anything approaching the precision of time-correlations to which we in the Jurassic are accustomed. But here at least the concepts of primary and secondary standards seem to be slowly becoming accepted. For a recent review, see Cope (1996; 2003)].

In its more refined, post-Oppelian form the Submediterranean secondary standard post-dates the primary standard by at least thirty years. Its origins lie in the Franconian - Swabian White Jura and the history of its development is confused by the widespread mixing of bio- and lithostratigraphical units (Quenstedt, - - ...). The first attempt to bring order into the confusion seems to have been by Arkell (1946, 1956, Tables 9, 10). One senses his frustration in the texts. The 'Oxfordian/Kimmeridgian boundary' was drawn between the Planula Zone (still 'Oxfordian') and the Galar/Platynota Zone ('Kimmeridgian'). This boundary was chosen not on any locally independent grounds but on what was presumed to be the closest *correlation* with the primary standard, the Pseudocordata/Baylei boundary. All the subsequent confusion has arisen because, following traditional loose usage, this independently-defined secondary standard Stage was given the same name as the primary standard: Kimmeridgian. To say that this secondary standard is roughly, *within the precision of correlation*, of the same age-range as the Kimmeridgian is not the same as saying it *is* the Kimmeridgian. And we all know how imprecise a correlation can be: in the present case, how downright incorrect it was (- and even so, after 50 years, nobody dead). And we also know how the miscorrelation arose: through an example of the one great weakness to which our beloved ammonites used as clocks are vulnerable, namely heterochronous homoeomorphies - in this case, the (mis)identification of a group of Swabo-Franco-Pomeranian '*Ringsteadiae*' and '*Pictioniae*' found in the Planula Zone, with the real thing, the English forms, which they do resemble up to a point. The problems were clearly stated in Sykes & Callomon (1979, p.842, text-fig.2) and, slightly higher, in Birkelund & Callomon (1985, p.40).

(3) Nomenclature. The Submediterranean secondary standard, being independently defined by its base, should therefore be also independently named (different type, different name: familiar in zoological nomenclature?). Two existing names seem to present themselves as possible candidates: the Crussolian of Rollier, 1909, and the Sequanian of Marcou, 1848. I am indebted to Raymond Enay for pointing out that the histories, contents, chronostratigraphies, boundaries, correlations, subdivisions and subsequent modifications of these units have already been fully set out by our French colleagues (Enay, 1980, Enay & Atrops, 1984, Enay, Contini & Bouillier, 1988). Each of these Stages would require some redefinition relative to its original and subsequent senses if now to be pressed into service as Submediterranean secondary standard, but the same could be said for almost all of

the standard Stages in use today - recall the evolution of the Bajocian, for example, through the partition of the Aalenian. What is at stake in the end however is merely the use of a name as an index, as a label.

The 'Crussolian' has connotations pointing to Crussol, in the Ardèche, and that at least has the merit of referring to a locality at which the Submediterranean 'Kimmeridgian' is classically developed and described. It was introduced in a rather obscure publication but this ensured that it has not collected a large baggage of subsequent interpretations. The 'Sequanien' predates the starting-date for standard stratigraphical nomenclature of 1850 proposed by Arkell (1946), which is no cause for great concern, but its subsequent use has been more extensive and varied in connotation. It is part of the Argovien-Rauracien-Sequanien triplet introduced for the Jura of the Franche-Comté and tied more to differences of facies than of age. The other two have long been abandoned for this reason. It was however adopted by Spath (Kutch, 1933, p.864, Correlation Table I) in a standard Stage sense, as part of a Sequanian - Havrian/Virgolian doublet whose boundaries coincide closely with those of the 'Lower Kimmeridgian - Upper Kimmeridgian' used for the Submediterranean Province since Luxembourg 1962. It is however still included in the Oxfordian in the more recent discussions (Enay *et al.* 1988), which attempt to define its chronostratigraphy in terms of the modern Submediterranean zonation, and that is perhaps where it should stay.

(4) Basal boundary stratotype (SSSP: Secondary Standard Section and Point). A change of name for the secondary standard Stage would present also a good opportunity to redefine its lower boundary more closely in line with what is now believed to be a closer correlation with the primary standard. This correlation - still approximate but now at the higher precision of ammonite faunal horizons rather than that of whole Subzones or Zones - is currently based on the occurrence of *Amoeboceras bauhini* in Britain and in Swabia (Schweigert & Callomon 1997). It relies on the comparisons of whole *assemblages* of ammonites from precisely defined stratigraphical horizons rather than on sporadic specimens from only roughly known levels (in the White Jura). How precise the implied time-correlation is remains itself somewhat uncertain, for in Britain, *A. bauhini* occurs as an immigrant slightly above the base of the Baylei Zone and the range of the species is not yet well known anywhere. In Swabia, it occurs in the top of the Hauffianum Subzone, the highest of three Subzones of the Bimammatum Zone. One solution - the nomenclaturally most conservative - would therefore be to promote the Hauffianum Subzone to full Zone and to make it the lowest Zone of the Crussolian. That would leave the main body of the now restricted Bimammatum Zone still in the Oxfordian, below. The lowest faunal horizon in the Hauffianum Zone and hence of the Crussolian Stage would then be that of *Orthosphinctes tizianiformis* (Choffat). But there are other solutions: I cannot myself become involved in the details.

That presents the logic of the problem and the outline of a solution. It may not be widely popular. But

attempts to compromise by shifting the primary standard away from Kimmeridge for the sake of a single unified GSSP *sensu* ICS would be worse: the preference for theoretical tidiness over practical scientific reality. And the problems of precise correlation between Subboreal and Submediterranean successions would remain as before, unchanged and unresolved.

(5) The Boreal Secondary Standard. The standard zonation based on the evolution of the genus *Amoeboceras* introduced for the Boreal Province (Sykes & Callomon, 1979) is driven by the same problems as those discussed above for the Submediterranean Province, created by the bioprovincial endemism of the ammonites used as geological clocks. The standard zonal succession used in the Arctic differs from that of the primary Subboreal zonation and hence, in principle, a new name should be found for it also. But there is sufficient biogeographical overlap for its base to be taken to coincide with that of the primary Kimmeridgian, to be that of the Baylei Zone, and no confusion should then arise through miscorrelations of the bases. No harm would come, therefore, from referring to the Boreal succession as also ‘Kimmeridgian’ in broad terms, if no closer dating in terms of a specified Zone is intended, or as ‘Boreal Kimmeridgian’ to be a little more precise if needed. The selection of a Boreal SSSP at the base of the *Pictonia densicostata* horizon at Staffin, in the Isle of Skye, would therefore be perfectly acceptable but little more than a formality.

(6) Further secondary standards. Lest we think solutions of our European problems are the end of the matter: not so. They are of limited interest to those working for instance in Mexico (see Callomon in Westermann (ed), 1992, p.261, Table 12.3) or in Kutch and Madagascar. But we need not worry about these here. Further secondary standards can always be set up as needed. The criterion is usefulness.

(7) The upper limits of the primary and secondary standards. By the convention now generally accepted, the top of a standard chronostratigraphical unit is defined to be the base of the overlying unit. The top of a secondary standard Crussolian Stage is therefore unambiguously and automatically the base of the overlying Stage, the Tithonian, which takes over the role of primary standard for the top Stage of the Jurassic System. (How that base is itself to be defined is of course a separate problem that we need not consider here). But what of the primary Kimmeridgian itself?

Here we run into the old problem alluded to above, arising from the misunderstanding of the term ‘Portlandian’ as applied to the French and English successions by d’Orbigny, based on a misidentification of yet another homoeomorphic pair of ammonite species, this time those of the genera *Gravesia* and *Titanites*. The confusion was clearly recognized already by Blake (1881) and subsequently by Salfeld (1913). It was partially resolved by general agreement arising out of proposals put forward at Luxembourg (Maubeuge (ed) 1962, p.79 et seq.), that ‘Kimmeridgian’, ranging

up to the base of the Tithonian, should be used in the restricted sense (*‘sensu gallico’* of authors) at least in the Submediterranean Province. That makes it the very Stage whose redefinition as Crussolien has been discussed above. In Britain, a compromise was retained in that the Kimmeridgian Stage was divided into Lower and Upper Kimmeridgian Substages (see Cope in the Geological Society’s *Correlation Charts*, 1980), the boundary to lie at the base of Blake’s bed 42 at Kimmeridge, the base of the *Pectinatites elegans* Zone. This brings us back to original problem: how does the Lower Kimmeridgian *sensu anglico* correlate with the Kimmeridgian *sensu gallico*, the Upper Kimmeridgian *sensu anglico* with the Tithonian – all these Stages as defined by their boundaries?

A solution was proposed already by Blake himself and has been revived by Cope (1993, 2003). It is to recognize the Upper Kimmeridgian of Britain as an independent secondary standard Stage, to be identified by an independent name: the Bolonian Stage. All that would be needed to bring this solution up-to-date would be the formal designation of a boundary stratotype, the SSSP. The practical designation has already been made: the base of Blake’s bed 42. The definition of the Stage in terms of its contained Zones and Subzones is also already complete. The problem of the correlation of the base of the Bolonian with that of the Tithonian remains of course unchanged. But it becomes clearly seen as a practical problem of correlation, unbedevilled by confusion and uncertainties arising from problems of nomenclature.

Additional reasons for re-naming the Upper Kimmeridgian *sensu anglico* come from the subdivision in the meantime of the Kimmeridgian *sensu gallico* (*alias* Crussolian) itself, into ‘Lower Kimmeridgian’ and ‘Upper Kimmeridgian’ Substages. Clearly, there are several nomenclatural problems that the ISJS could usefully attempt to regulate, besides those of primary stage boundary stratotypes.

Stage boundary stratotype sections: action

(1) The primary standard (PSSP): Dorset, east of Weymouth. There are several sections from which one could be selected, all of them described in considerable detail: Ringstead, Osmington Mills, Black Head. But what matters above everything else is the ability to *recognize* the *means of correlating* the boundary more widely. This is the faunal horizon of *Pictonia densicostata*. It is present in all these sections: forget the ability also to recognize the horizon of *Ringsteadia evoluta* below and all those sedimentological arguments about how “complete” the sections are, how “continuous” sedimentation was across them. Select one, by toss of a coin if all else fails.

The *densicostata* horizon is in fact one of the finest markers in the Jurassic of Europe: it can be followed precisely in a bed never more than a metre thick from Dorset through Wiltshire (especially around Swindon) to Oxfordshire, Buckinghamshire and then to South Ferriby, just south of the Humber; thence to Staffin Bay in Skye. But not in Normandy: non-sequence, the lowest horizon seen there is that of *P. baylei*, distinct,

above *P. densicostata*. (For illustrations of *P. baylei*, see Hantzpergue 1989, pls. 20-24). And not in Poland: the specimens from there compared with *P. densicostata* may be close but are not identical. Excellent reference sections could be designated at Swindon, which has yielded immense collections of ammonites and other invertebrates (now in the Oxford University Museum); at South Ferriby, which has a more close to continuous succession across the boundary but a less abundant and restricted ammonite fauna; and Staffin, which has a stronger representation of the Boreal elements of the ammonite fauna but sparse other invertebrates. The clay-facies at South Ferriby and Staffin may be good for micro- and nanofossils.

(2) The Submediterranean secondary standard (SSSP). Decide the solutions to be adopted of the Stage problems analysed above, then select a type-section. Plettenberg? Crussol?

(3) Reference sections and their correlations: Poland? Southern France? Iberia?

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**GERMAN STRATIGRAPHIC
COMMISSION – SUBCOMMISSION ON
JURASSIC STRATIGRAPHY:
Report of the year 2003
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Michael SCHUDACK**

After eight years (two terms of office) the Chairman and Secretary of the Subcommission were changed (in accordance with the regulations) at the end of 2003 by voting of the 15 Ordinary Members of the Subcommission. The new chairman is Dr. Eckhard Mönnig, Naturkunde-Museum Coburg, Park 6, 96450 Coburg, Germany; email e.moennig@naturkunde-museum-coburg.de. The new secretary is Dr. Michael Schudack, Institut für Geologische Wissenschaften, Freie Universität Berlin; email schudack@zedat.fu-berlin.de. See also the website of the Subcommission: <http://jurasubkom.pal.uni-erlangen.de/>

In 2003, the annual meeting of the German Subcommission on Jurassic Stratigraphy took place from May 28 - 31 in Kirchheim unter Teck, a town about 20 km southeast of Stuttgart at the foot of the Swabian Alb. It was organized by G. Dietl and G. Schweigert, both from the Natural History Museum in Stuttgart, and 30 colleagues attended. The area is in the