

THE PERMIAN-TRIASSIC BOUNDARY: RECENT DEVELOPMENTS, DISCUSSION AND PROPOSALS

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Introduction

As past chairmann of the Subcommittee and member of the Permian-Triassic boundary Working Group (PTBWG), I had some reservations about the sudden rush to adopt the Meishan section for the global stratotype and point (GSSP) of the Permian-Triassic boundary (PTB) and I asked Professor Yin not to press a vote on PTB.

A strong pressure has been made after the successive publications of Yin et al. (1994), Yang et al. (1995), Yin et al. (1996a) and Yin (1996b). But an important effort has been made by Yin, ed. (1996 a) with the publication of a special volume on the boundary with an up-to-date presentation of 3 other GSSP candidates: the Shangsi section (Lai et al. 1996b), the Selong section (Jin et al. 1996) and the Guryul Ravine section (Kapoor 1996).

In marine area, new data and interpretations have been recently published on :

- the Selong section (Orchard et al. 1994), (Mei 1996d), (Mei 1996c) and (Wang & Wang 1995);
 - the Spiti sections (Krystyn & Orchard 1996);
 - the Kashmir sections (Atudorei et al. 1995; Baud et al. 1996a);
 - the Salt Ranges sections (Baud et al. 1996a);
 - the Canadian Arctic (Ellesmere Island) sections (Baud et al. 1996b, Henderson & Baud 1996);
 - the Spitzberg sections (Wignall & Twitchett 1996);
 - the Negev sections (Eshet et al. 1995);
 - the Sicily sections (Gullo & Kozur 1993; Kozur 1995a)
- Also new concepts have been developed by Mei (1996a and 1996b).

Discussion

Recent publications on the boundary contain critical views on:

- 1- the paleontological determination and recognition of *I. parva* species;
- 2- the so called synchronicity of the First Appearance Datum (FAD) of *I. parva*;
- 3- the so called lineage of *H. latidentatus*, *I. parva*, *I. turgida* and *I. isarcica*.;
- 4- the choice of the Meishan section for the GSSP.

1- About the paleontological determination of *I. parva* species, the *H. latidentatus* from bed 25 in the Meishan section (Zhang et al. 1995) is in fact an *I. parva* morphotype as discussed by Orchard (1996b) and by Mei (1996d). About recognition of *I. parva* species, Wang (1994) note (p. 238) "there is indistinction and confusion". He proposed to split the species in morphotype I, morphotype II and postparva. This proposal, I am afraid, will bring more difficulties with the choice of an "index" morphotype for the Permian-Triassic boundary and only an hyperspecialist will be able to determine the "good morphotype".

2-The synchronicity of the FAD of *I. parva* has been claimed by Yin (1995b) and Yin et al. (1996b) based on seemingly consistent biostratigraphic position.

This view has been strongly contested by Li et al. (1996) who wrote: "The *I. parva* zone is a range zone whose lower boundary is not defined ...and the definition of the P-T boundary point by the first appearance of *I. parva* is untenable"

Mei (1996c) also does not agree on the use of FAD and wrote "...it is unaproprate for correlations".

It is interesting to note that FAD of *I. parva* in the Shangsi section is above the first *Ophiceratids* and *Claraia*, it is below in the Meishan section and that the FAD of *I. parva* in the Selong section is synchronous with the appearance of *Otoceras latilobatum*.

As shown by Henderson & Baud (1996), this species appears at the base of the *Ophiceras* zone in Ellesmere Island profiles, about 28m above the first *Otoceras* and *Claraia*.

I. parva is a shallow water form with facies-controlled immigration (Orchard, 1996a and b). In addition to the difficulties to recognise the good morphotype, we agree with Li et al. (1996) and Mei (1996c) that FAD of *I. parva* is not synchronous and will bring confusion in determining the P/T Boundary.

3- the lineage of *H. latidentatus*, *I. parva*, *I. turgida* and *I. isarcica* (discussion in Ding et al. 1996 and in Yin et al. in press) receives severe criticism by experienced conodont specialists. Orchard in Krystyn & Orchard (1996) found *H. latidentatus* emmend. above *I. parva* FAD and co-occurring with this species in Spiti area. In the Shangsi section *I. turgida* appears 3.2m below the first *I. parva* (Lai et al. 1996b). The conclusions of these authors are that the relationships between *I. parva*, *I. turgida* and *I. isarcica* remain to be resolved. Both Orchard in Krystyn & Orchard (1996) and Mei (1996d) do not agree with the supposed cline from *H. latidentatus* to *I. isarcica*.

4- The choice of the Meishan section for GSSP.

The Meishan section is one of the most frequently and best studied section in China and I congratulate our Chinese colleagues for their very impressive and detailed work. But it appears that it is one of the most condensed section among the candidates for the GSSP. Based on the thickness of the "*I. parva* zone", Lai et al. (1996a) concluded that the sedimentation rate in the Meishan section is 40 times lower than in the Shangsi section. If we compare the thickness of the *Hypophiceras/Otoceras* zone, it is of about 0,25m in Meishan, 0,4m in Shangsi, 0,5m in Selong, 0,4m in Kuling (Spiti), about 9m in Guryul Ravine (Kashmir) and 45m in Griesbach Creek (Arctic Canada).

In the Meishan section, 6 important facies changes occur within 0,3m in the critical interval of the P/T boundary between bed 24e and 29a (Yin et al. 1996a).

According to the guidelines of the ICS for GSSP, a stratigraphic condensation does not satisfy the geological requirements and numerous facies change in the critical interval of a boundary are in contradiction with the biostratigraphical requirement for a GSSP. It is the reason why I disagree with the proposal of Yin (1993), Kozur (1995b, 1996) Yang et al. (1995), Wang et al. (1996) and Yin et al. (in press) on the choice of the Meishan section as global stratotype and point (GSSP) of the Permian-Triassic boundary (PTB).

Conclusions and proposals

The choice of *I. parva*, a shallow water conodont species as index for the basal Triassic brings more problems than it resolves.

Other indices for the Permian-Triassic boundary have to be found and a fossil assemblage is more appropriate. Even Yin (1995a) recognises that an assemblage is (theoretically) better than an unique species. As demonstrate by Orchard (1996a) and Mei (1996d), the deep water Neogondolellids (*Clarkina*) have been subject to an important faunal renewal at the critical Permian-Triassic boundary interval. The simultaneous appearance of *N. meishanensis*, *N. taylorae*, *N. carinata*, *N. orchardi* is a very good criteria to precise the boundary. Appearance of at least of a part of this assemblage corresponds to the base of *O. boreale* in the Arctic (Henderson & Baud 1996), the base of *O. woodwardi* or *O. latilobatum* in the Himalaya, to the bed 25 in Meishan and to the FAD of *I. parva* in Selung (Mei, 1996d).

The Meishan section does not satisfy the geological requirements nor the biostratigraphical requirements for a GSSP.

A candidate section has to be found or in the Himalaya where fossiliferous marine Triassic rocks are well developed, or in the Arctic Axel Heiberg or Ellesmere Islands where stratotypes of the early Triassic substages occur. These Arctic Islands provide very nice exposures with a good record of index species, a high rate of sedimentation and tens of meters of monofacies development at the Permian-Triassic boundary. Otto Fiord South section on NW Ellesmere Island (Henderson & Baud 1996) can be an excellent candidate as global stratotype and point (GSSP) of the Permian-Triassic boundary (PTB).

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