

*Euflemingites* in bed 15A (= O 3). Option 1 represents the most distinct ammonoid boundary, which seems to correlate with the onset of the *N. waageni* group also in Chaohu, China (Tong et al., 2003), a datum preferred by the Subcommittee on Triassic Stratigraphy. It may be recognizable by conodonts in the Boreal realm through disappearance of *C. nepalensis*. Options 2 and 3 are less distinctive ammonoid boundaries despite the fact that the pandemic genus *Euflemingites* may represent the only direct stratigraphic link between low and high palaeolatitudes faunas within the whole time interval.

From a biochronological viewpoint, Muth is an obviously superior site compared to Chaohu, the other presently proposed candidate (Tong et al., 2003). The Chaohu sections have a) fewer macrofaunal elements, confined to an interval above the proposed boundary, and b) miss *C. nepalensis* as a complementary boundary proxy. Muth on contrary shows a reduced sediment accumulation rate reaching only half of the boundary beds thickness of Chaohu. Demonstration of sedimentary completeness and stratigraphic continuity is thus fundamental in Muth and is provided by the described successive appearance data of phylogenetically related ammonoid and conodont taxa. A severe handicap of Muth section is a regional thermal overprint (CAI 3,5) that precludes a reliable magnetostratigraphy. A meaningful chemostratigraphy, however, is still possible (Atudorei, pers. comm.) and scheduled for 2005.

- Bhargava, O. N., Bassi, U. K., 1998. Geology of Spiti-Kinnaur Himachal Himalaya. Geol. Surv. India Mem., 124: 1-210.
- Bhargava, O. N., Krystyn, L., Balini, M., Lein, R., Nicora, A., 2004. Revised litho- and sequence stratigraphy of the Spiti Triassic. *Albertiana*, 30: 21-39.
- Bhatt, D. K., Joshi, V. K., Arora, R. K., 2004. Conodont biostratigraphy of the Lower Triassic in Spiti Himalayas, India. *Journal Geological Society of India*, 54: 153-167.
- Diener, K., 1897. Himalayan fossils. The Cephalopoda of the Lower Triassic. *Palaeontologia Indica*, (ser. 15) 2(1): 1-191.
- Krafft, A., Diener, C., 1909. Himalayan fossils. Lower Triassic Cephalopoda from Spiti, Malla johar, and Byans. *Palaeontologia Indica*, (ser. 15) 6(1): 1-186.
- Krystyn, L., Balini, M., Nicora, A., 2004. Lower and Middle Triassic stage boundaries in Spiti. *Albertiana*, 30: 39-53.
- Tong Jinnan, Zakharov, Y. D., Orchard, M. J., Yin Hongfu, Hansen, H. J. 2003. A candidate of the Induan-Olenekian boundary stratotype in the Tethyan region. *Science in China*, 46: 1182-1200.
- Waterhouse, J. B., 1996. The Early and Middle Triassic ammonoid succession of the Himalayas in western and central Nepal, Part 3: Late Middle Scythian ammonoids. *Palaeontographica*, 241: 101-167.
- Zhao Laishi, Orchard, M. J., Tong Jinnan, 2004. Lower

Triassic biostratigraphy and speciation of *Neospathodus waageni* around the Induan-Olenekian boundary of Chaohu, Anhui Province, China. *Albertiana*, 29: 41-43.

## A revised Lower Triassic intercalibrated ammonoid-conodont time scale of the eastern Tethys Realm based on Himalayan data.

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The Himalayas are known since long as host of large and diverse Lower Triassic faunas, most of which unfortunately lack precise stratigraphic distribution data in the rock record. Useless from viewpoint of modern biochronological standards they otherwise are of great importance for their substantial historic contribution to the chronostratigraphic subdivision of the Lower Triassic stages and substages. Bearing that in mind a thorough reinvestigation of sections in Spiti from where a major part of the fauna was derived, has been started within recent years (Krystyn et al., 2004).

Results of the study lead to a considerable improvement of the (eastern) Tethyan ammonoid zonal scheme with the introduction of new zones around the Gangetian (=Griesbachian) – Brahmanian (=Dienerian) and the Dienerian – Smithian boundary (fig. 1). Correlated on a regional scale with other schemes established in the eastern Tethys (Salt Range, Tibet, southern China) as well as on a long distance scale with those from western Panthalassa (Primoriye) and from the Arctic (Canada, Siberia) the actual superiority of the Himalayan faunal sequence will be demonstrated and discussed. In the light of the presented data a reinstallation of parts of the classical stage and/or substage terminology of Mojsisovics et al., 1895 against younger and less adequate subdivisions (i.e. Induan, Griesbachian, Dienerian) is highly recommended and should be considered

### References

- Krystyn, L., Balini, M. and Nicora, A., 2004: Lower and Middle Triassic stage and substage boundaries in Spiti. *Albertiana*, 30 Suppl.: 39-52.
- Mojsisovics, E. v., Waahen, W. and Diener, C., 1895: Entwurf einer Gliederung der pelagischen Sedimente des Trias-Systems. *Sitzungsber. Akad. Wiss Wien, math.-naturwiss. Kl.*, 104: 1279-1302.

| St.                    | Subst.   | Ammonoids                            | Conodonts                 | Bivalves            |
|------------------------|--|--------------------------------------|---------------------------|---------------------|
| OLENEKIAN              | Spathian   | undifferentiated                     | <i>N. gondolelloides</i>  |                     |
|                        |  | <i>Tirolites</i>                     | undifferentiated          |                     |
|                        |  | <i>Nordopficeras</i>                 | <i>I. collinsoni</i>      |                     |
|                        | Smithian   | <i>Anawasatchites / Anasibirites</i> | <i>G. milleri</i>         | "P." <i>himaica</i> |
|                        |  | <i>Juvenites / Meekoceras</i>        | <i>N. waageni</i>         |                     |
|                        |  | <i>Euflemingites</i>                 |                           |                     |
|                        |  | <i>Flemingites griesbachi</i>        |                           |                     |
|                        |  | <i>Rohillites rohilla</i>            |                           |                     |
|                        | Diener. Gandar.                                    | <i>Prionolobus sp. A</i>             | <i>C. nepalensis</i>      |                     |
|                        |  | <i>Gyronites frequens</i>            | <i>N. cristagalli</i>     |                     |
| Griesbachian Gangetian | " <i>Pleurogyronites</i> "<br><i>planidorsatus</i> | <i>N. kummeli</i>                    | <i>Claraia griesbachi</i> |                     |
|                        | <i>Discopficeras</i>                               | <i>Ng. discreta</i>                  |                           |                     |
|                        | <i>Ophiceras tibeticum</i>                         | <i>I. isarcica</i>                   | <i>Ng. krystyni</i>       |                     |
|                        | <i>Otoceras woodwardi</i>                          | <i>H. parvus</i>                     | <i>Ng. meishanensis</i>   |                     |
|                        | <i>Otoceras clivei</i>                             |                                      |                           |                     |

Fig. 1: Ammonoid and conodont zones in the Lower Triassic of Spiti.

**End-Permian Extinction and Biotic Recovery: A Complete Record from an Isolated Carbonate Platform, the Great Bank of Guizhou, South China**

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The end-Permian extinction and subsequent Early Triassic biotic recovery are exceptionally well recorded in marine strata of the Nanpanjiang Basin, south China. The Nanpanjiang Basin is a deep-marine embayment in the

southern margin of the Yangtze Plate, which was located in the Eastern Tethys near the equator during the Permian and migrated northward to approximately 12°N by the beginning of the Middle Triassic (Enkin et al., 1992; Enos, 1995).

Several isolated carbonate platforms within the basin contain conformable Permian-Triassic boundary (PTB) sections and expanded well exposed Lower and Middle Triassic sections. The Great Bank of Guizhou (GBG) is the northernmost platform and it contains the longest uninterrupted Permian and Triassic sections in the basin, spanning the interval from the Upper Permian through the Late Triassic (Lower Carnian). Stratigraphic sections through the PTB and Lower-Middle Triassic recovery interval are exposed in the platform interior, platform margin, and basin margin. A detailed chronostratigraphy for the basin margin sections on the GBG is constrained by conodont biostratigraphy, magnetostratigraphy, carbon isotope stratigraphy, and U-Pb age dates. Exposure of a two-dimensional cross-section enables physical correlation between platform and basin strata.

The GBG nucleated on antecedent topography near the Permian margin of the Yangtze Platform during transgression in the Late Permian. The GBG evolved from a low-relief bank rimmed with oolite shoals and gentle basin-margin slopes during the Early Triassic to a *Tubiphytes* reef-rimmed platform with more than 400 m of relief and