The Precambrian – Cambrian Boundary in Siberia

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For more than ten years, the difficult problem of the Precambrian-Cambrian boundary has been intensely studied by a Working Group of the IUGS Subcommittee on Precambrian Stratigraphy together with IGCP Project 29. Candidates for the stratotype boundary have been narrowed to localities in China, Newfoundland, and Siberia. Although there are, naturally, arguments for and against each section proposed, it is expected that a final choice will be made within the near future. In this article, the author describes key sections in Siberia, Kazakhstan and Mongolia, including one of the main boundary candidates on the Aldan River of Western Siberia, in the Ulakhan-Sulugur section at the base of the *Aldanocyathus sunnaginicus* zone of the Tommotian stage.

Fundamental Considerations

Since the Precambrian-Cambrian boundary is rather special, suggestions have long been made for its establishment based on geological or physical characteristics rather than on purely palaeontological criteria. However, it is now clear that only biostratigraphical criteria will lead to a solution of this problem. With such profound differences between late Precambrian and Cambrian biotas, it was necessary to accept the principle that "the Precambrian-Cambrian boundary stratotype point should be placed as close as is practicable to the base of the oldest stratigraphical unit to yield Tommotian (*sensu lato*) fossil assemblages" (Cowie, 1978). This principle was based on the idea that the boundary should be along the base of the first zonal assemblage bearing abundant skeletal fossils, in this case archaeocyathids, gastropods, hyolithids, tommotiids and brachiopods (e.g. Rozanov, 1966, 1967; Rozanov *et al.*, 1969).

The appearance of a wide variety of skeletal fauna in the early Tommotian does not, of course, mean that those groups arose here for the first time. This was the time when many groups of animals first developed the ability to form skeletons, although the cause of this instantaneous geological phenomenon is not yet clear.

There are also certain interesting connections with global abiotic changes associated with the transition from the Vendian to the Cambrian. These include a decrease in dolomite accumulation, a sharp drop in stromatolite formation, the first widespread appearance of red biogenic limestones, and a global accumulation of phosphorite – the largest and richest deposits in the U.S.S.R., Mongolia and China are Tommotian (Fig. 1). Although the causes for these events are not yet clear, the finding of what is regarded as the earliest rich Tommotian association in a

particular section does not lead us to suspect a migration effect or the presence of another rich assemblage in older layers elsewhere.

Of course the process of skeletalization, in the broad sense, was probably prolonged. Moreover, there was first a long period (probably the major part of the Vendian) when all skeleton formation was just partial scleritization of certain body-parts, and only in the Tommotian (or a little earlier in a few groups) did the formation of "real" skeletons begin, for example, in molluscs and brachiopods.

Palaeogeographic considerations are also of great importance (Fig. 1). By the early Tommotian, the palaeogeographic situation was such that normal marine carbonate sedimentation was localized primarily in eastern Siberia. Consequently, sections with the richest faunas are located there, and it is there that the centres of origin and initial diversification of a number of skeletal-forming groups were located.

Figure 1: Tommotian palaeogeography: 1 – volcanic rocks; 2 – land; 3 – dolomites; 4 – evaporites; 5 – limestones; 6 – terrigenous rocks. Open circles – archaeocyathids; solid triangles – rich associations of small shelly fossils (SSF); open triangles – poor associations of SSF; open squares – *Platysolenites*; solid squares – the richest deposits of Tommotian phosphorites. PL-region of *Platysolenites* distribution, and TR-region of rich Tommotian associations of SSF.