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High-resolution Olenekian (Lower Triassic) conodont unitary association zonation: global distribution and paleogeographic implications

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The latest Permian through Early Triassic was a critical time that witnessed major changes in Earth's biosphere resulting from a succession of biologic and environmental events following the end-Permian mass extinction. A precise Early Triassic global timescale is essential to understand the relative timing of these events in order to calibrate marine ecosystem recovery during this interval. The Lower Triassic includes the Induan and Olenekian stages. The Global Stratotype Section and Point (GSSP) for the base of the Induan and Permian-Triassic boundary is defined at the Meishan section in South China, corresponding to the first appearance of the conodont *Hindeodus parvus*. However, the Induan-Olenekian boundary (IOB) remains undefined; this hinders the establishment of a high-resolution chronostratigraphic framework for the entire Early Triassic. In this paper, we present recent study results of Olenekian conodont unitary association zones (UAZs) from a series of sections in South China, Himalaya, North America, Canadian arctic, southwest Japan, and others that overall constitute the circum-Paleotethys Ocean and the Panthalassic Ocean areas. We demonstrate a total of thirteen worldwide UAZs in the interval from IOB to the Smithian-Spathian boundary, while 7 UAZs, 8 UAZs, and 9 UAZs are regionally recognized from North America, Himalaya, and South China, respectively. The UAZ analysis suggests that a highly correlative boundary could be placed within Bed 24 at the Pingdingshan West section, Anhui Province, South China, which is a candidate site for the IOB GSSP. The unitary association zonation offers a good test for previous biostratigraphic zonations and has significance for studying Olenekian conodont evolution, provincialism and paleogeographic distribution. As a result of this study, two new widely distributed conodont taxa are described that significantly refine the conodont zonation of early-middle Smithian and help improve accuracy in correlation of stratigraphic divisions and the IOB interval.