The Ordovician - Silurian Boundary of Honghuayuan section, Tongzi, South China; evidence from organic carbon isotope profiles.

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The environmental changes across the Ordovician - Silurian boundary is accepted as one of the Phanerozoic Big Five mass extinction events and the extinction event had two primary pulses caused by the latest Ordovician Hirnantian glaciation.

Yangtze Platform is one of the best study areas in the world Ordovician - Silurian boundary sections because Yangtze Platform was located as continental sea in the equatorial zone and shallow and deep marine sedimentary facies on the same basin.

The late Ordovician and early Silurian strata are exposed at several places in Yangtze Region, South China. Wangjiawan section, Yichang in Hubei province, was authorized as the Global Stratotype Section and Point (G.S.S.P.) of the base of the Hirnantian Stage by complete graptolite biozones (Chen et al. 2006). The organic carbon isotope profiles at Wangjiawan section show a positive excursion in the Kuanyinchiao Bed,(Wang et al. 1997; Hamada 2001; Chen et al. 2006; Kotani 2006), which is a marker of the uppermost Ordovician system in Yangtze Platform, such as another Ordovician - Silurian boundary sections worldwide.

On the other hand, Honghuayuan section, Tongzi in Guizhou province, is located in south 100 km of Chongqing, 550 km SW from Wangjiawan, and reconstructed as representing comparatively shallow marine facies in the west margin of the Yangtze Platform (Chen et al. 2000). The Ordovician - Silurian boundary at Honghuayuan section is not defined yet because of a lack of the index fossil of graptolite, though Honghuayuan section is believed to provide continuous sequence throughout the late Ordovician to the early Silurian.

We have identified five stratigraphic units Honghuayuan section and correlated all of the five units to those of the Wangjiawan section across the Ordovician - Silurian boundary, based on the organic carbon isotope profiles, TOC profiles, and mineralogy, coupled with reported graptolite biozone data.

Unit 1 (D. complexus Zone and P. pacificus Zone):

Black shale. TOC were high. d13C were maintained stable.

Unit 2 (N. extraordinarius - N. ojsuensis Zone):

Non-calcareous black shale changed to calcareous gray shale. TOC fluctuated significantly. d13C was increasing and showing two positive excursions.

Unit 3 (Lower part of the Kuanyinchiao Bed):

Gray shale with micritic limestone layer. TOC were very low, while d13C continued to increase upward.

Unit 4 (Upper part of the Kuanyinchiao Bed):

Two limestone layers and calcareous gray shale. TOC values were kept low level, while d13C showed a remarkable and sharp positive excursion.

Unit 5 (C. vesiculosus Zone):

Gray shale with thin black shale. TOC were a little high. d13C dropped to nearly constant.

Rong et al. (2002) and Chen et al. (2006) placed the OSB within the Kuanyinchiao Bed, however, the integrated geochemical and biostratigraphic signatures suggest that the Ordovician - Silurian boundary occurred above the Kuanyinchiao Bed such as Wangjiawan section. New stratigraphic division has revealed that the sedimentation rate was dramatically reduced and hiatus or condensed sequence developed toward the Ordovician - Silurian boundary in Honghuayuan section.

Onset of the Hirnantian glaciation of the latest Ordovician seems to correspond to the first pulse of the extinction and the primary productivity rose up increased terrigenous nutrients. At the maximum of the glaciation, the positive excursion of d13C suggested the primary productivity reached the maximum level by increased influxes of terrigenous nutrients and upwelling nutritious deep water. The second pulse of extinction, postdated the sharp drop of d13C profiles, may have been caused by input of unidentified 13C depleted DIC to the ocean.