A comparative study between the Permian/Triassic boundary event and Toarcian anoxic event

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Permian/Triassic boundary (PTB) is known as the greatest mass extiction event in Phanerozoic, while Toarcian (TOA) event has experienced less conspicuous mass extinciton event. Both events, however, are considered to be related with oceanic anoxia (e.g. Isozaki, 1997; Jenkyns, 1985) and a simultaneous activity of flood basalt (ex. Wignall, 2001). The PTB and TOA events are studied in detail on shallow carbonate rocks and deep chert sequences independently. Comparison of these two events and two different depositional settings such as deep and shallow probably deepen an understanding of the change in evironment of ocean.

Comparison with PTB and TOA (focused on the lithlogy of chert sequence)
lithofacies change
∗Black shale intercalated in the radiolarian chert sequence in both PTB and TOA. The thickness of the TOA black shale is 50 cm, while that of the PTB is approximately 2 meters.
∗Radiolarian chert changes its color from gray to black within the interval of 50 cm (approx. 500 thoundand years) below the TOA black shale, while the change occurs from by far the lower stratigraphic position in the PTB.
∗The sedimentation of the TOA black shale sharply stops and is replaced by gray green radiolarian chert, while the recovery from the environment of the PTB black shale is gradual and elapsed around 4 million years.

Chemical compositions of the black shales
∗The content of Al2O3 is significantly higher in the PTB black shale than the TOA black shale.
∗Redox sensitive elements such as U, V, and Mo is highly concentrated in the both black shales, but Th/U and V/(V+Ni) ratios are higher in the PTB black shale.

Comparison with shallow and deep ocean
∗Positive excursion spanning 3 million years of TOA had been considered to be a result of the storage of light organic carbon in the TOA black shale, but the timing of both events found to be not simultaneous and the origin of heavy carbon is remained ambiguous (McArthur et al, 2000). Sharp negative spike predated/inserted in the positive excursion had been interpreted to be caused by dissociation of gas hydrate (Hesselbo et al., 2000), but the hypothesis is rejected by Mattoli et al. (2004).
∗Well known negative excursion at the PTB had been explained by the dissociation of gas hydrate (Erwin, 1994), but the idea is also disputed (Kakuwa and Matsumoto, 2005). Repeated and magnitude of positive and negative excursions of carbon isotopic ratios are reported from the Early Triassic, but the cause for the excursions remained ambiguous (Payne et al., 2004).
∗The change in carbon isotopic ratio recorded in shallow carbonate rocks and fossils represents the change in the global carbon cycle. The TOA and PTB black shale on the ocean bottom should have had an influence on the carbon cycle, but their contribution to the cycle is not clarified yet.