



Depositional environment of Upper Devonian radiolarian cherts from Loei, Northeastern Thailand: Constraint from rare earth element and major element geochemistry

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In Thailand, Devonian as well as Upper Palaeozoic sequences are exposed in a narrow belt, located to the west of the Khorat Plateau of the Indochina block. However, the depositional environment of Devonian cherts is poorly known. The studied samples were collected from three sections located in Loei, northeastern Thailand. Radiolarians obtained from these bedded cherts including *Astroentactinia multispinosa* (Won 1983), *Stigmosphaerostylus variospina* (Won 1983), *Trilonche davidi* (Hinde 1899), *Trilonche echinata* (Hinde 1899), *Trilonche elegans* (Hinde 1899), *Trilonche guangxiensis* (Li & Wang 1991), *Trilonche hindea* (Hinde 1899), *Trilonche minax* (Hinde 1899), *Trilonche vetusta* (Hinde 1899), *Bisyllentactinia arrhinia* (Foreman 1963) *Palaeoscenidium cladophorum* (Deflandre 1953), *Archocyrtium* sp., *Polyentactinia* sp. and *Protoholoeciscus* sp. indicate a late Devonian period. Using major element geochemistry, the analyzed cherts had high silica content (>90 wt.%), high aluminum content and low iron content ($\text{Al}_2\text{O}_3/(\text{Al}_2\text{O}_3+\text{Fe}_2\text{O}_3)$: means 0.91, 0.88 and 0.92). The $\text{Al}/\text{Al}+\text{Fe}+\text{Mn}$ values were high in both cherts and interbedded shales (mean 0.89). High $\text{Si}/\text{Si}+\text{Al}+\text{Fe}$ ratios were observed in cherts (mean 0.97) and slightly low in shales (mean 0.69), whereas $\text{Fe}_2\text{O}_3/\text{TiO}_2$ values were low (mean 5.91). For rare earth element (REE) analysis, the cherts were characterized by low La abundances (means 4.31, 3.59 and 4.22), slightly negative Ce anomalies (Ce/Ce^* : means 0.81, 0.76 and 0.93), intermediate ratios of North American Shale Composite (NASC) normalized La_n/Ce_n (means 1.33, 1.37 and 1.12) and intermediate La_n/Yb_n values (means 0.79, 0.94 and 1.22). REE characteristics in the interbedded shales were similar to the cherts. These geochemistry results revealed a continental margin environment for the chert sequences. High $\text{Si}/\text{Si}+\text{Al}+\text{Fe}$ values suggest biogenic origin of these cherts, however, additional silica content in the cherts could be the result of diagenetic alteration. Intermediate positive Eu anomalies (Eu/Eu^* : means 1.32, 1.25 and 1.44) were interpreted as the result of detrital feldspar contribution, which was compatible with distinctive low content of Fe. Weathered materials and fragments of basalts and andesites could suggest the source of sediments which supplied to the basin during deposition of cherts.

Keyword: Late Devonian, geochemistry, rare earth element, major element, radiolarian chert, depositional environment