Periodicities in bed thickness of Mesozoic bedded chert in Hozukyo, Tanba Belt, Southwest Japan

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The bedded cherts are generally characterized with alternations of several centimeter thick chert bed and millimeter thick shale parting. The bedded cherts occasionally show rhythmical variations in bed thickness. Although there are several studies which attempted to demonstrate periodicities of these rhythms and explore their origin, no conclusive results were obtained with respect to their periodicities and origin.

In this study, Triassic to Lower Jurassic bedded cherts of the Tanba Belt exposed along the Hozu River, 10 km to the west of Kyoto were examined on their litho-facies and bed thickness. This section is located about 500m to the south of JR Hozukyo station. In the outcrop, the bedded cherts shows stable strike of N65 and dip is almost vertical. The studied section is approximately 10 m thick, which is not folded nor faulted. Chert beds and shale partings are laterally continuous, stable in thickness, and never split nor amalgamated. So, it is easy to identify each layer and determine its thickness. Accordingly, this section is ideal for measuring the thicknesses of cherts and shales to investigate their periodicities.

The section is divided into 9 units based on their lithology, which are described as follows in ascending order.

Unit A is 0.6 m thick, and composed of gray bedded cherts characterized with pinch & swell structure. Shale partings are generally thin.

Unit B is 1.5 m thick, and composed of gray bedded cherts characterized with flat and parallel bedding plane with thick shale partings.

Unit C is 1.7 m thick, and composed of gray bedded cherts characterized with pinch & swell structure. Shale partings are generally thin.

Unit D is 1.5 m thick, and composed of gray bedded cherts characterized with flat and parallel bedding plane. Shale partings are generally thin.

Unit E is 0.4 m thick, and composed of gray thin bedded cherts with thick shale parting.

Unit F is 0.7 m thick, and composed of gray bedded cherts characterized with pinch & swell structure. Shale partings are generally thin.

Unit G is 1 m thick, and composed of black massive cherts characterized with pinch & swell structure without shale partings.

Unit H is 0.8 m thick, and composed of black bedded chert characterized with flat and parallel bedding plane with thick shale partings.

Unit I is 0.9 m thick, and composed of light blue bedded chert characterized with flat and parallel bedding plane with thick shale parting.

Based on observation in the field, 10 to 30(17 in average) chert beds tend to form a bundle of approximately 30cm thick, which are recognized because bundle boundaries show a tendency to be separated easily. The bundle boundaries are usually characterized by a thick shale parting and a thick chert bed directly under the shale.

To study the cause of this bundle structure, thicknesses of chert beds and shale partings were measured bed by bed continuously. Visually, chert bed thickness fluctuates with periodicity of 4 to 5 beds, whereas shale parting thickness fluctuates with periodicities of 5 to 15 beds.

Spectrum analysis of chert and shale bed thickness time series was conducted. Periodicities of 6, 10, 25, and 200 beds are recognized for chert. Periodicities of 15, 25 and 200 beds are recognized for chert.

We also examined the correlation in thicknesses of cherts and adjacent shales. There is no correlation between the thickness of the chert and that of shale parting above or below the chert. However, after smoothing of the data with 17 points moving average, the correlation between the two becomes evident in each unit. Negative correlations between the chert and shale thicknesses are common, although positive correlation is obtained for Unit A.

In this presentation, the periodicity and the relation between chert and shale thicknesses are discussed to investigate the origin and sedimentation mechanism of bedded cherts.