Lithofacies variation between different thrust sheets in the Lower Triassic pelagic deep-sea strata in Tsukumi, Oita, Japan

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Lateral lithofacies variation in pelagic deep-sea sedimentary rocks in the accretionary complexes in Japan has attracted relatively little attention. Apart from the Lower Triassic interval, the lithofacies of pelagic deep-sea strata is uniformly composed of bedded chert (Isozaki et al., 2010; Wakita and Metcalfe, 2005), and seems to be traceable over wide areas. It has been believed that the lithofacies of the Lower Triassic interval, which is dominated by siliceous claystone instead of bedded chert, is also laterally continuous (Isozaki et al., 1997; Sakuma et al., 2012; Takahashi et al., 2009). However, too few well-dated sections were available to confirm this assumption.

In this study, we investigated the Lower to lowermost Middle Triassic strata in the pelagic deep-sea Enoura Formation (Nishi, 1994) of the Chichibu Belt in Tsukumi, Oita Prefecture, southwest Japan. We investigated the lithostratigraphy of pelagic deep-sea sedimentary rocks in two localities: Ajiro Island and Enoura. The two localities are approximately 1 km apart. According to our field mapping, the strata in the two localities belong to different thrust sheets. In Ajiro Island, the lithofacies is dominated by an alternation of dark grey chert and light grey siliceous claystone. There, chert and siliceous claystone make up most of the thickness (47% and 33% respectively). On the other hand, the lithofacies in Enoura is dominated by ‘cherty’ claystone and siliceous claystone. In Enoura, ‘cherty’ claystone and siliceous claystone make up most of the thickness (43% and 32% respectively), while chert contributes to a small proportion (9%). Based on conodont biostratigraphy, the age of the strata in Ajiro Island was revealed to be upper Olenekian (Spathian) to lower Anisian (Aegean), while the strata in Enoura were dated as Spathian. Despite some stratigraphic discontinuities due to faults in Ajiro Island, the conodont-based age assignment showed that the age of the strata in the two localities undoubtedly overlap in the lower to middle Spathian interval. As already mentioned, the lithofacies in the two localities are clearly different. Therefore, our results indicate that lithofacies of pelagic deep-sea sedimentary rocks can vary significantly at least between different thrust sheets even in a relatively small area.

We also conducted X-ray fluorescence (XRF) analysis to evaluate the content of major elements of the sedimentary rocks. Our XRF analysis showed as expected that the sedimentary rock types distinguished during logging in the field reflected the silica (SiO_2) content of the rocks. Chert has the highest SiO_2 content (~95%), followed by ‘muddy’ chert (~90%), ‘cherty’ claystone (~80%) and siliceous claystone (~75%). By combining the results of XRF analysis with the results of stratigraphic logging, we compared the SiO_2 content of the lithofacies in Ajiro Island and Enoura. Consequently, the difference in the calculated SiO_2 content of the lithofacies in Ajiro Island and Enoura is less than 5%. Thus, the SiO_2 content of the lithofacies in the two localities does not differ significantly.

The formation of chert from siliceous sediments requires diagenetic transport of silica (Si) from relatively Si-poor areas to adjacent Si-rich areas (Murray and Jones, 1992; Tada, 1991). A plausible explanation for the difference in the lithofacies in Ajiro Island and Enoura, which have similar SiO_2 contents, is that it results from diagenetic effects: the alternating chert and siliceous claystone lithofacies in Ajiro Island may have formed through greater diagenetic redistribution of Si compared to the 'cherty' claystone and siliceous claystone dominant lithofacies of Enoura. If this interpretation is correct, it would mean that the lithofacies of pelagic deep-sea siliceous sedimentary rocks would become different due to different degree of diagenetic Si redistribution, even if the original composition of the sediments are the same.

Keywords: Enoura Formation, conodont, X-ray fluorescence, chert, siliceous claystone, diagenesis