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Tephra chronology and stratigraphy in the northwestern Pacific since the Messinian: ODP Sites 1149 and 1779

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Tephra layers recovered during Ocean Drilling Program Legs 185 and 191 at Sites 1149 and 1179 in the northwestern Pacific allow us to develop a new combined $^{40}Ar/^{39}Ar$ and magnetostratigraphic chronology for the northwestern Pacific and to study the stratigraphic evolution of the northwestern Pacific since the Messinian. Major changes in the sedimentation rates observed at 0.780 Ma and 3.6 Ma at Site 1149, and at 2.5-3.0 Ma at Site 1179, coincide with peaks in ash frequency and cumulative ash thickness. Because climate cooling is the common factor for the increase in sedimentation rates at both Sites, we hypothesize increased transport of sediment to these areas may be associated with cool climates and stronger trade winds carrying both dust and ash from Asia. This is supported by the position of dated ash layers at both Site 1149 and Site 1179 for the last 2.1 Ma, which correlate with cold stages or cooling trends in the isotopic curve. Sedimentation of ash layers at Site 1149 likely increases during cooler than present times, when the Kuroshio Current moves south. Additionally, contradictory high sedimentation rates observed at the more distal Site 1179 compared to Site 1149 are attributed to high-productivity in the nutrient-rich waters in the area of convergence between the Kuroshio Front and the Oyashi Current where Site 1179 is located.

Tephra stratigraphy studies are also relevant to “Subduction Factory” research. Based on color, tephras from both Sites appear to be chemically bimodal (i.e., basaltic and rhyolitic), with infered rhyolitic volcanic events dominating during the Messinian, at the beginning of the Early Pliocene (i.e., from 4.290 to 5.3 Ma), and through most of the Quaternary. Cumulative thicknesses of the ash layers at Sites 1149 and 1179 are 5.3 % (6.4 m) and 0.5 % (1 m), respectively, of the total sediment deposited during the last 7 Ma. Taking into consideration the mass fraction of dispersed ash in the background sediment, the total thickness of volcanogenic components at Sites 1149 and 1179 to be subducted in the Izu-Bonin and Kuril Trenches, respectively, could vary between 12-42 m (10 to 33.3%) and 3-13 m (1.5% to 6.5%).

Finally, the new refined $^{40}Ar/^{39}Ar$ and magnetostratigraphic chronology for the northwestern Pacific provides with a good tool for future geochemical correlations on a wide geographical scale that are needed to resolve the detailed evolution of arc volcanism in the Izu-Bonin and Japanese arcs.