

Newly discovered young lava fields on the Cretaceous Pacific Plate between the Japan Trench and the outer-rise

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The northwestern part of the Pacific Plate subducting beneath NE Japan is comprised of Early Cretaceous abyssal oceanic lithosphere and Early to Late Cretaceous seamounts and guyots. Until recently, no present-day volcanic activity had been documented on the cool, thick, and old Cretaceous lithosphere; however, Hirano et al. (2001) reported the presence of anomalously young alkali-basalt lavas (5.95 ± 0.31 Ma) on the subducting, ~130 Ma Pacific Plate.

The trench-oceanward slope is characterized by trench-parallel (N-S) normal faults with some NNW or NNE faults, resulting from bending of the subducting Pacific Plate. These normal faults have created horst and graben structures that are approximately 5 km in length and have 100 m to 500 m of vertical displacement. Some hummock structures can also be observed on the faulted abyssal plain using seabeam sonar bathymetric mapping. The Miyako Knolls contain such features, characterized by the presence of amorphous volcanoes having elongated outer limbs that are truncated by the horsts and grabens of normal faults. The Miyako Knolls hummocks and some of the horst and graben fault walls are recognized in the seabeam sonar data by the presence of ocean floor with high acoustic intensity. The newly discovered lava fields include all hummocks in the Miyako Knolls as well as the underlying sheet flow, which is covered with pelagic sediment deposited since Late Miocene times. We also discovered potential other young lava fields using SEABEAM2112 sidescan sonar along the Japan Trench to outer-rise (Hokkaido Rise).

The young lavas on the currently aseismic ocean floor can be interpreted as eruptions that occurred near the flexural part of the outer-rise (Hokkaido Rise) prior to subduction of the Pacific Plate into the Japan Trench.