

The Adakite Geochemical Component and the Torn Pacific Plate Beneath the Western Aleutians and Kamchatka

Details

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Abstract

Late Pleistocene-Holocene volcanic rocks at Sheveluch Volcano in the Aleutian-Kamchatka junction (AKJ) are mostly andesites with relatively high Mg#, Sr/Y, and low Y compared to andesites of the Klyuchevskoi Group volcanoes immediately to the south. The geochemical characteristics of Sheveluch andesites suggest the presence of an adakite component in the magma source beneath the AKJ. Such a geochemical component is commonly associated with the subduction of young/warm lithosphere, but the subducting plate beneath the AKJ is relatively old. We suggest that the adakite geochemical component may be produced by slab rollback and induced mantle flow that warms and melts the northern edge of the Pacific plate as it passes beneath the AKJ. Roll back not only imposes a heat source on the slab edge, but also explains the position of the volcanic arc, and the high magma production rates in the Kamchatka central depression. In the modern Aleutian arc, the adakite geochemical signature is present only in singular Late Pleistocene lava that was dredged from a key transitional area immediately west of the place where the central Aleutian deep seismic zone disappears, and east of where the large, western Aleutian strike-slip faults cross the arc. The adakite component in this area may also be a geochemical edge effect which is produced because the slab is heated by mantle flow around three sides of a torn plate edge. If the edge-effect interpretation for young volcanic rocks in the AKJ and western Aleutians is correct, it implies that the Pacific plate is being torn in an unzipping motion as it moves westward from the convergent to the strike-slip portions of the Aleutian arc.