Tectonic significance of Triassic sequences on the Wrangellia, Alexander, and Taku terranes, southeastern Alaska

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Initial terrane designations in 1972 in southeastern Alaska delineated Triassic sections on three separate terranes: Wrangellia on the west, Alexander in the center, and Taku on the east. By 1992, these terranes were considered part of an amalgamated insular superterrane, and all of the Triassic rocks were inferred to represent the Wrangellia component of the composite superterrane. The differences in the three Triassic sections are more useful considered separately, because they define and constrain the tectonic setting, timing, and facing directions of early Mesozoic events, and because specific types of ore deposits are unique to specific Triassic sequences.

The Paleozoic basements of the Wrangellia, Alexander, and Taku terranes each have a different stratigraphy. In the Wrangell Mountains, pre-Permian sequences of the Wrangellia and Alexander terranes are stitched by a Pennsylvanian pluton, and the terranes are inferred to have been amalgamated prior to Triassic time. There are no Paleozoic stratigraphic correlations between the Taku and Alexander terranes. Permian arc basement has been established by rock type and basalt chemistry for Wrangellia and the Taku terrane. Permian basalts on the Alexander terrane have not been analyzed, but the basalts and volcaniclastic turbidites are permissive of an arc.

The Triassic section on Wrangellia consists of 3-6 km of tholeiitic submarine and subaerial basalt flows of Carnian age, overlain by Norian to Lower Jurassic medium- to thick-bedded shelf limestone. There is no rhyolite on Wrangellia, as the terrane was originally defined. The Triassic section on the Alexander terrane comprises the Hyd Group, which consists of basal conglomerate or breccia overlain by meter-scale alternations of limestone, basalt, volcaniclastic rocks, carbonaceous argillite, and rhyolite. In places the thickness of rhyolite or basalt may be more than a km, but nowhere approaches the 3-6 km characteristic of Wrangellian Triassic basalts. On Admiralty Island, the Hyd Group is dominated by basalt. On Annette Island about 80 per cent of the Hyd Group is rhyolite, and only 5 per cent is pillow basalt. In Duncan Canal the Hyd Group is dominated by sedimentary rocks. The Hyd Group is also distinguished by numerous Ag-Pb-Zn-Ba deposits throughout southeastern Alaska that are not found in either Wrangellian or Taku Triassic rocks. Copper deposits are characteristic of the Wrangellia terrane. The Triassic section on the Taku terrane includes pillow basalt and limestone up to several hundred meters thick in a section of dominantly carbonaceous argillite and volcaniclastic sedimentary rocks. The Taku Triassic rocks are lithologically similar to Hyd Group rocks, except that the breccias, conglomerates, and rhyolite have not been recognized on the Taku terrane.

Triassic mafic volcanic rocks in the Wrangellian, Alexander, and Taku terranes have similar chemistry. Wrangellian basalts have LREE's that are 20-30 times chondrite, low Nb, low Ta, and plot in within plate and arc tholeiite fields on chemical discriminant plots, and have been interpreted as arc-rift tholeiites. Alexander Hyd Group basalts and Taku Triassic basalts have very similar chemistry to Wrangellian basalts, with LREE's that are 20 times chondrite, low Nb and Ta, and are inferred to represent arc-rift or marginal basin basalts based on immobile trace element discrimination diagrams. Rhyolites in the Hyd Group have within-plate chemistry; rhyolites have not been recognized in Wrangellian or Taku Triassic sections. Hyd Group rhyolites imply greater magmatic evolution for the Alexander terrane relative to Wrangellian volcanic rocks.

Wrangellian basalts are succeeded by shelf-type limestone deposits extending into the Lower Jurassic. Hyd basalts are associated with debris flows and fine-grained carbonaceous restricted-basin deposits, suggesting basin development. The Taku Triassic section is dominated by basinal deposits. Sedimentary facies of these three Triassic sections suggest a shallow, shelf environment for the Wrangellian deposits, which occur along the west margin of the composite superterrane. Sedimentary facies on the Alexander and Taku terranes indicate the formation of basins along the eastern margin of the composite superterrane. Crustal thinning along basin axes along the eastern margin may have allowed the rapid subsidence necessary for the huge thickness of the Jura-Cretaceous Gravina-Nutzotin belt flysch deposits, as well as permitting enough crustal weakening for faulting and offset between the western, Hyd flanks of the basins and the eastern Taku flanks of the basins. Facies interpretations support geochemical interpretations that Wrangellian Triassic basalts are shallow marine and subaerial rift basalts on the western margin of a Triassic arc that succeeded a Permian arc, but the Hyd and Taku Triassic volcanic and sedimentary rocks accumulated in rift basins on the east side of the arc.

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