Plate Tectonics and the Structural Evolution of the Aleutian–Bering Sea Region.

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Abstract

The general aspects of the structural evolution of the Aleutian-Bering Sea region can be described in terms of plate tectonics. Involved in this model is the formation of the Aleutian Ridge in latest Cretaceous or earliest Tertiary time. The ridge is presumed to have formed in response to a southward relocation in the convergence zone of the Pacific oceanic plate, a shift away from the Beringian continental margin connecting Alaska and Siberia to an oceanic location at the Aleutian Trench. Prior to the formation of the ridge, Pacific crust is presumed to have directly underthrust the northeast-trending Koryak-Kamchatka coast. The middle and late Mesozoic eugeosynclinal or thalassogeosynclinal masses that underlie this segment of the Pacific fold belt are highly deformed, thrust faulted, and intruded by ultramafic bodies-characteristics that can be ascribed to the mechanical and magmatic consequence of plate underthrusting. This model implies a similar orogenic process for the formation of the stratigraphically and structurally similar Mesozoic rocks underlying the northeast-trending continental margin of southern Alaska. Less intense underthrusting may have occurred along the northwest-trending Pribilof segment of the Beringian margin connecting Alaska and Siberia. This margin may have been more parallel to the approximate direction of relative motion between the oceanic and continental plates. Nonetheless, fold belts, possibly intruded by ultramafic masses, formed along this segment of the Beringian continental margin in Late Cretaceous and perhaps earliest Tertiary time. The folds have since subsided below sea level-their eroded tops presently underlying as much as 3 km of virtually undeformed Cenozoic deposits. Our model relates pre- and postorogenic deposits underlying the Beringian margin and adjacent coast to the time of formation of the Aleutian Ridge, which marked the cessation of continental underthrusting and the beginning of island-arc underthrusting. Our model also implies that the ridge formed near or at its present location and that oceanic crust of late Mesozoic age underlies the Aleutian Basin of the Bering Sea. Since formation of the ridge this basin has received from 2 to 10 km of sedimentary fill. Although the model we suggest broadly explains the observed changes in tectonic style, magmatic history, and sedimentation for the Aleutian-Bering Sea region, it also implies that thousands of kilometers of oceanic crust underthrust the Kamchatka, Beringian, and Alaskan margins between Late Triassic and Late Cretaceous time, and hundreds of kilometers underthrust the Aleutian Ridge in Cenozoic time. The enormous masses of pelagic and volcanic offscrapings that would be indicative of extensive or long-term crustal underthrusting are not apparent as mappable units. Thus, while our model may be stylistically adequate, it paradoxically predicts quantities of rocks and structures that we are not able to find. Presumably they have been subducted.

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