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Title: RIDGE SUBDUCTION BENEATH THE AMERICAS: NEW RESEARCH FOUNDED ON THE WORK OF W.R. DICKINSON AND W.S. SNYDER

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Abstract: The transition from speculation to understanding of ridge-trench intersections began with a landmark paper entitled “Geometry of subducted slabs related to San Andreas Transform” by W.R. Dickinson and W.S. Snyder in 1979. That paper provided new insight into the mechanism of ridge subduction, and initiated what has become a new plate tectonic paradigm: the slab window. Over the past twenty-eight years, their seminal work has been cited over two hundred times and applied to geological environments from around the world, both modern and ancient.

The west coast of the Americas has been repeatedly affected by ridge-trench interactions from Mesozoic to Recent time. Subduction of the Kula-Farallon, Kula-Resurrection and Farallon-Resurrection spreading ridges beneath North America resulted in anomalous and time-transgressive forearc to backarc magmatism and related tectonism in Cretaceous to Eocene time. Subsequently, the Neogene Farallon-Pacific ridge system intersected the North American trench in western Canada and the southwestern United States, and

caused anomalous magmatic and tectonic effects that continue to the present. Divergent subduction of the Nazca and Cocos plates led to development of a slab window beneath Central America. Patagonia has been the site of localized ridge subduction from the Eocene to the Recent, with the Phoenix-Farallon ridge subducting from the Eocene to the early Miocene, and the Nazca-Antarctic ridge from the Miocene to the present. The Antarctic peninsula over-rode diverging Antarctic-Phoenix ridge subduction from the Eocene to the Pliocene. In all cases, normal arc magmatism was interrupted or eliminated by anomalous igneous activity ranging in signature from adakitic to intraplate.

Current research on slab windows involves geochemical, tectonic, and thermal modeling. A new geochemical analysis on the effects of Miocene to Recent subduction of the northern segment of the Farallon (Juan de Fuca)-Pacific ridge is underway. A symmetrical arc-intraplate-arc geochemical pattern is evident in a transect from the northern Cascade Arc, through the volcanic fields of British Columbia, Yukon and eastern Alaska, and into the Aleutian Arc. This pattern can be explained by Neogene displacement of the arc-metasomatized mantle wedge caused by upwelling oceanic-type asthenosphere, as predicted by slab-window models. A new model of slab anatexis beneath Patagonia is under development, and initial results suggest that spreading within the Scotia plate may have been augmented by upwelling related to slab-window formation. Theoretical thermal effects on the forearc before, during and after ridge subduction are being investigated with computer modeling. 3-D models support empirical studies that call for forearc melting in response to ridge subduction. Adakite magmatism above slab windows may involve melting of slab edges or remelting of arc basalt emplaced previously into the lithospheric mantle.