Mesozoic-Cenozoic Tectonic Evolution of Western North America—an Alternative to the Orocline

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A time-lapse sequence for the Lower Jurassic of North America-Siberia positions is used, geared to Mid-Atlantic opening rates and pole of rotation, to show a possible linkage between the Pacific and Arctic oceans. With a pervasive and long-lasting right lateral movement on all terranes west of the Rocky Mountain Trench (Tintina system), one can perceive Alaska, Yukon, British Columbia, and the western states as a complex of transported microplates joined by transform faults and sutures. The modification of these boundaries and the creation of structural salients in the northern Cordillera are credited to a lower Tertiary collision of the Alaskan Brooks block and Chukotka with the eastward moving Kolyma shield complex. The concept introduces a possible linkage between the extinct Kula-Farallon Ridge and the Alpha Cordillera and credits spreading within the Arctic to Barents Shelf migration by spreading away from Alaska, between the Nansen fracture zone and the Taymyr trend.

The microplate fabrics of both Alaska and eastern Siberia favor accretionary processes, with all blocks carried out of the Pacific region or along the west edge of the North American craton, rather than rifting away from Arctic Canada.

INTRODUCTION

The intent of this paper is not so much to show original research as to collect others’ diverse thoughts concerning the eastern Pacific rim. This overview was developed to maintain consistency of regional studies in outer continental shelf oil-leasing preparations by Champlin Petroleum Company. Collage tectonics is experiencing a broad usage in the oil industry because of involvement in many scheduled sales on displaced terranes with the realization that training both exploration staff and management is essential at an early stage of basin exploration to evaluate potential and possible lack of economic opportunity. In fact, in the early stages of basin exploration, the conjectures on collage mechanics and regional seismic character are generally the only means of judging appropriate action. The overview here has been developed as a framework within which we can promote additional local work on individual basins.

So much good work has been accomplished both by Canadian and by United States’ workers in regional terrane displacements that it overwhelms the rapidly moving exploration staff. Our first effort to establish consistency is to emplace generality overall, continually adding details locally to reach an adequate explanation for seismic identifications, both structurally and stratigraphically, such as “are we looking at marine or nonmarine rocks, and of what age; what were the probable depositional controls; or what can be said for temperature gradients through time?”

Only two items of original nature were developed early in this study: a conversion of the A.P. Markovsky Eurasian tectonic map to the same projection as the P.B. King North American map and the collection of available magnetic stripe data in the Pacific, Atlantic, and Arctic Oceans and the Bering Sea to construct rate charts through time isolated to activity on specific plates. The use of a myriad of published data followed with the goal of withdrawing relationships at the rates established at the individual spreading ridges.

By the rules of basic regional geology and not so much by pure collage tectonics, some basins appeared amazingly straightforward in their solution, while other presently controversial problems remained as insoluble as ever. One of these areas is the Arctic in which one must choose an open or closed situation in the Jurassic prior to its development as we know it now. This study favors an open Arctic that will be closed to continuing Pacific activity by right lateral transform activity.

BASIC PLATE MOVEMENT SCENARIO

The system developed here is simplistic, based on North American movement rotating along trajectories of small circles oriented to the middle Atlantic spreading center of rotation (Figure 1a) near the south tip of Greenland and basically against one very particular small circle—the Rocky Mountain Trench-Tintina-Taymyr Peninsula trend. All terranes to the west or south of this line are driven by spreading much higher rates in the present Pacific area. In essence, both sides of this later terrane junctions (sutures) in western North America have moved northwest, but the west sides at much higher rates, so they are right lateral. North American plate movement is very much more dependably calculated in both rate and direction than the movement of the accreted terranes of the west. This lack of dependability of high rates arises from the action of asymmetric spreading and the destruction of such