A SIMPLE TECTONIC MODEL FOR CRUSTAL ACCRETION IN THE SLAVE PROVINCE: A 2.7-2.5 Ga "GRANITE-GREENSTONE" TERRANE, NW CANADA

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A prograding (direction unspecified) trench-arc system is favored as a simple yet comprehensive model for crustal generation in a 250,000 km^2 "granite-greenstone" terrane (1). The "greenstone" belts are seen as synformal remnants of a formerly continuous complex of tectonically accreted seamounts, remnant arcs, aseismic ridges, submarine plateaus and microcontinents. (Off-ridge volcanism was important in the Archean ocean because the ability of increased plate accretion to dissipate the estimated heat flux from the earth's interior was limited by the buoyant resistance to subduction of very young lithosphere.) The bathymetric highs, veneered atop by chemical sediments and aproned by indigenous clastics, were buried by kms of orogenic turbidites upon entry into the trench. Landward of the trench axis, the previous bathymetric highs and overlying trench turbidites were structurally detached (and foreshortened) from the underlying or surrounding "ophiolitic" crust and mantle, which were then subducted. The accretionary complex was later massively intruded by late-to post-tectonic plutons of the prograding magmatic arc, volcanic levels of which have been eroded away. As in Cenozoic arcs, variation in plutonic suites may be attributable to buoyant and non-buoyant subduction. The regional pattern of anastomosing "greenstone" belts may reflect the interference of first-order, NW and NNE striking, pinched synforms, spaced 70-120 km apart.

The model accounts for the evolutionary sequence of volcanism, sedimentation, deformation, metamorphism and plutonism, observed throughout the province. It accounts for both unconformable (trench inner-slope) and subconformable (trench outer-slope) relations between the volcanics and overlying turbidites. It admits the existence of relatively minor amounts of "pre-greenstone" basement (microcontinents) and "syn-greenstone" plutons (accreted arc roots). It predicts a variable age gap between "greenstone" volcanism and trench turbidite sedimentation (accompanied by minor volcanism). It also predicts systematic regional variations in age spans of volcanism and plutonism. An efficient test of the model would be a regional Sm-Nd study of the late plutons, predicting "syn- to post-greenstone" model ages for bulk crust-mantle separation.

Previous models (1,2), interpreting the "greenstone" belts as continental rifts, do not account for the observed deformation and metamorphism, nor for the myriad of late- to post-tectonic plutons, the ages of which cluster 40-100 Ma younger than the dated "greenstones" (3). They fail to explain the general absence of rift-type clastics in the lower volcanics and predict the inverse stratigraphic sequence from that observed (ie. subsidence and trench-type sedimentation preceding submarine volcanism, as the lithosphere progressively attenuates). They are incompatible with existing isotopic evidence (4,5) for massive crust-mantle separation following "greenstone" volcanism, and with evidence from detrital zircon dating (6) that the preponderance of turbidite source rocks were significantly younger than the "greenstone" volcanism.

Implications of the model will be illustrated with reference to a new 1:1 million scale geological map of the Slave Province (and its bounding 1.9 Ga orogens) compiled by the author as preparation for the "Decade of North American Geology" volume on the Canadian Shield.

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