Comunicaciones Nº 42 - 1991: 157 - 160
Departamento de Geología, Universidad de Chile, Santiago

SOUTHWEST U.S.-EAST ANTARCTIC (SWEAT) HYPOTHESIS: A SECOND LO0K

Moores, Eldridge M.,
Departament of Geology, University of California, Davis, CA 95616-8605, and

Dalziel, Ian W.D.,
Institute for Geophysics, University of Texas at Austin, Austin, TX 78712-8345

In two recent papers on a possible late Precambrian connection between the North American and East Antarctic-Australian cratons (Moores, 1991; Dalziel, 1991), we propose a hypothesis for a late Precambrian fit of western North America with the Australia-Antarctic shield region that permits the extension of many features through Antarctica into other parts of Gondwana. Specifically, the Grenville orogen may extend through Dronning Maud Land of Antarctica into Malagasy and through the Eastern Ghats of India to the Albany-Frazer belt of southwest Australia. The Yavapai-Mazatzal orogen has equivalents in the Shackleton Mts and parts of the Transantarctic Mts. The Wopmay orogen of northwest Canada may extend through eastern Australia into Antarctica and connect beneath the ice with the Yavapai-Mazatzal orogen. Late Precambrian sedimentary rocks of the Belt-Purcell supergroup, Canada-U.S., in the Uinta Mts., and Death Valley, CA, may have equivalents in the Transantarctic Mts., as well as in the Kalahari Craton (Hartnady, 1986). Ophiolitic rocks of the Yavapai-Mazatzal orogen of Arizona, and Dronning Maud Land of Antarctica imply the existence of a Proterozoic ophiolite belt of regional extent. Geophysically prominent features of the North American Precambrian continent may extend beneath the East Antarctic Ice Sheet.

The proposed correlation has several related implications: 1. The continuity of ophiolitic rocks and/or massif-type anorthosites between North America, Antarctica, India, and Malagasy has significance for the resolution of the Proterozoic ophiolite and anorthosite problems. 2. Boundaries of Precambrian orogenic belts constitute piercing points along the edges of cratons that may provide, absent abundant reliable paleomagnetic data, the most dependable means of reconstructing Precambrian continental configuration. 3. Laurentia may have constituted a pie-shaped piece between Australia-Antarctica, or "East Gondwana" and the western margin of South America or "West Gondwana". The separation of Laurentia from "East Gondwana" and "West Gondwana" in the late Precambrian, coincident with the amalgamation of Gondwana along the late Precambrian Pan-African orogens, *sensu lato* (Hoffman, 1991), and the subsequent Laurentia-Gondwana collision along the Appalachian orogen implies the closure of a Pacific-sized ocean during opening of the Panthalassic Ocean. Thus ocean basins the size of the Pacific may be an integral part of the "Wilson Cycle".

Despite these important implications, it is clear that details of the timing of rifting and drifting and of the exact original configuration of the continents remain to be worked out. For example, rifting of both the Australia-Antarctic and western Laurentian margins clearly began in the latest Precambrian, but subsidence curves for North America suggest that the drift transition could have been somewhat later (Bond et al., 1984), even towards the time when the Australia-Antarctic margin was experiencing the Delamerian-Ross orogeny in the latest Cambrian to earliest Ordovician (Borg et al, 1990). In addition, a number of Precambrian to lower Paleozoic terranes are present along the Pacific margins of the Americas and Antarctica which may have played a role in a complex rifting history of these margins. Terranes that might represent pieces rifted off North America, South America and/or Antarctica include the Oaxaca terrane of Mexico (Ortega-Gutierrez, 1981, Campa and Coney, 1983), the Santa Marta massif of Colombia (Gansser, 1955, Mac Donald and Hurley, 1969), the Arequipa massif of Peru-Chile (Vicente, 1990), the Chilenia terrane of southern South America (Ramos et al., 1986), and Marie Byrd Land of Antarctica (Dalziel, 1991). Furthermore, Hartnady (1986) has suggested a connection between the Kalahari craton and western North America based upon geologic similarities in the two regions. Thus the pre-rift continental configuration and the shapes of the rifted margins of Australia-Antarctica, North America, and South America remain to be worked out.

The biogeography of early Cambrian faunas perhaps can shed light upon the timing of rifting by comparing similar vs. dissimilar faunas (Signor and Moores, 1991, work in progress). For example faunal differences in Cambrian limestones in the Transantarctic mountains and western North America suggest the presence of a biologically significant deep oceanic barrier between the two continents at the time that the first fossiliferous Cambrian limestones were deposited (Dalziel, 1991). Such deep oceanic barriers in the modern world generally are divergent plate boundaries (e.g. Valentine and Moores, 1972). Future work on the uppermost Proterozoic and lowermost Cambrian rocks are more likely to bear upon the validity of this hypothesis. Bell and Jefferson (1987) have already provided some evidence in their correlation of rocks of western Canada and southeastern Australia. Other fruitful comparisons might include rocks in the Transantarctic and Shackleton mountains of Antarctica with rocks in the Death Valley, California-central Arizona region of the U.S., and rocks exposed in Dronning Maud Land of Antarctica with Grenville-age exposures in North America and South America. No doubt there are many other such comparisons that could be made.

REFERENCES CITED

Bell, R.T., and Jefferson, C.W., 1987, An hypothesis for an Australian-Canadian connection in the Late Proterozoic and the birth of the Pacific Ocean, *in* Proceedings, Pacific Rim Congres '87: Parkville, Victoria, Australian Institute of Mining and Metallurgy, p. 39-50.

Bond, G.C., Nickeson, P.A., and Kominz, M.A., 1984, Breakup of a supercontinent between 625 Ma and 555 Ma: New evidence and implications for continental histories: Earth and Planetary Science Letters, v. 70, p. 325-345.

Borg, S.G., DePaolo, D.J., and Smith, B.M., 1990, Isotopic structure and tectonics of the central Transantarctic mountains: Journal of Geophysical Reserach, v. 95, p. 6647-6667.

Campa, M.F., and Coney, P.J., 1983, Tectono-stratigraphic terranes and mineral resource distributions in Mexico: Canadian Journal of Earth Sciences, v. 20, p. 1040-1051.

Dalziel, I.W.D., 1991, Pacific margins of Laurentia and East Antarctica-Australia as a conjugate rift pair: evidence and implications for an Eocambrian supercontinent; Geology v. 19, 598-602.

Gansser, A., 1955, Ein beitrag zur geologie und petrographie der Sierra Nevada de Santa Marta (Kolumbien, Südamerica): Schweizerische Mineralogische und Petrographische Mitteilungen, v. 35, p. 209-79.

Hartnady, C.J.H., 1986, Was North America ("Laurentia") part of southwestern Gondwanaland during the late Proterozoic era?: Suid-Afrikaanse Tydskkrif vir Wetenskap, v. 82, p. 251-54.

MacDonald, W.D., and Hurley, P.M., 1969, Precambrian gneisses from northern Colombia, South America: Geological Society of America Bulletin, v. 80, p. 1867-1872.

Moores, E.M., 1991, Southwest U.S.-East Antarctic (SWEAT) connection: a hypothesis: Geology, v. 19, p. 425-428.

Ortega-Gutierrez, F., 1981, Metamorphic belts of southern Mexico and their tectonic significance: Geofisica International, v. 20, p. 177-202.

Ramos, V.A., Jordan, T.E., Allmendinger, R.W., Mpodozis, C., Kay, S.M., Cortés, J.M., and Palma, M., Paleozoic Terranes of the central Argentine-Chilean Andes: Tectonics, v. 5, p. 855-880.

Signor, P.W., and Moores, E.M., 1991, Early Cambrian biogeography and late Proterozoic plate tectonics, GSA Abstracts with Programs, San Diego metting.

Valentine, J.W., and Moores, E.J., 1972, Global tectonics and the fossil record: Journal of Geology, v. 80, p. 167-184.

Vicente, J.C., 1990, Early Late Cretaceous overthursting in the western Cordillera of southern Peru: in G.E. Erickson, M. T. Cañas and J. Reinemund, Eds., Geology of the Andes and its relation to Hydrocarbon and Mineral Resources, Circum-Pacific Council for Energy and Mineral Resources, Houston, p. 91-118.