Antarctic Ice Mass Change and Predictions of Crustal Seismicity and Lithospheric Stress

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Numerous examples in Laurentia and Fennoscandia of bedrock offsets that postdate late-Quaternary glacial polish suggest faulting caused by postglacial rebound. Over the past 5 years the theory of postglacial faulting has witnessed some major advances. The effect of glacial isostatic adjustment (GIA) on the faulting potential of the Antarctic lithosphere is examined here. Our application assumes an incompressible rheology, permitting a semi-analytical theoretical development. Our metric is the quantity, ΔF, defined by *Wu and Hasegawa [GJI Vol. 125, 1996]* as the differential Coulomb stress. In earthquake stress transfer theory this is called the Coulomb failure stress change. One feature of GIA in Antarctica is that substantial ice load change has probably continued up to mid-Holocene times and possibly at a reduced rate up to the present. This is in contrast to most of North America and Fennoscandia, where ice mass change ceased in early Holocene times. A revision of the D91 Antarctic ice history of *James and Ivins [JGR Vol. 103, 1998]* is used as input to calculations of stress change in the Antarctic lithosphere. The revised load includes recently developed constraints on grounding line retreat in the Ross Sea, coastal Antarctic Peninsula, and Weddell Sea regions, and new constraints on interior ice heights at Last Glacial Maximum (LGM). During the culmination of LGM, seismicity is suppressed relative to the 'no-load' reference state although the suppression is limited in its spatial extent. The relatively youthful deglaciation in some parts of Antarctica produces large present-day values of ΔF of 1 to 8 MPa at depths of 12 - 19 km within the Antarctic crust. These ΔF values are a factor of 20 or more larger than those computed recently for the postseismic stress shadowing effects in the Californian and Anatolian interplate shear zones. This suggests that ice loading effects in Antarctica are important in modulating and possibly generating seismicity. It will, however, be important to evaluate the effect of possible values of the poorly known background tectonic stress in future studies, as the background stress also affects predictions of the Coulomb failure stress change.