Evidence for Subglacial Volcanic Activity Beneath the area of the Divide of the West Antarctic Ice Sheet

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There is an increasing body of aeromagnetic, radar ice–sounding, heat flow, subglacial volcanic earthquakes, several exposed active and subglacial volcanoes and other lines of evidence for volcanic activity associated with the West Antarctic Rift System (WR) since the origin (~25 Ma) of the West Antarctic Ice Sheet (WAIS), which flows through it. Exposed late Cenozoic, alkaline volcanic rocks, 34 Ma to present concentrated in Marie Byrd Land (LeMasurier and Thomson, 1990), but also exposed along the rift shoulder on the Transantarctic Mountains flank of the WR, and >1 million cubic kilometers, of mostly subglacially erupted "volcanic centers" beneath the WAIS inferred from aeromagnetic data, have been interpreted as evidence of a magmatic plume. About 18 high relief, (~600-2000 m) "volcanic centers" presently beneath the WAIS surface, probably were erupted subaerially when the WAIS was absent, based on the 5-km orthogonally line spaced Central West Antarctica aerogeophysical survey. All would be above sea level after ice removal and isostatic adjustment. Nine of these high relief peaks are in the general area beneath the divide of the WAIS. This high bed relief topography was first interpreted in the 1980s as the volcanic "Sinuous Ridge " based on a widely spaced aeromagnetic –radar ice sounding survey (Jankowski et al,. 1983). A 70-km wide, circular ring of interpreted subglacial volcanic rocks was cited as evidence of a volcanic caldera underlying the ice sheet divide based on the CWA survey (Behrendt et al., 1998). A broad magnetic "low" surrounding the caldera area possibly is evidence of a shallow Curie isotherm. High heat flow reported from temperature logging (Clow et al., 2012) in the WAISCORE and a thick volcanic ash layer in the core (Dunbar et al., 2012) are consistent with this interpretation. A 2 km-high subaerially erupted volcano (subglacial Mt Thiel, ~78.5 degrees S, 111 degrees W) ~ 100 km north from the WAISCORE could be the source of the ash layer if it has been recently active. Models by Tulaczyk and Hossainzadeh (2011) indicate >4mm/yr Basal melting in the general area of the WAIS, again supportive of high heat flow and the presence of subglacial lakes in West Antarctica. These various lines of evidence lead to the general interpretation that the ice divide area of the WAIS overlies present to recent subglacial volcanic activity that may have an influence on the past and future behavior of the WAIS.