Active-Recent Volcanism Associated With the West Antarctic Rift System Interpreted From Aerogeophysical Observations, and Possible Effects on the Stability of the West Antarctic Ice Sheet (WAIS)

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Observations from an oversnow traverse in 1957-58 during the International Geophysical Year and >10,000 km of widely spaced airborne magnetic profiles acquired over the West Antarctic Ice Sheet (WAIS) in the early 1960s, indicated numerous high-amplitude, shallow-source, magnetic anomalies over a very extensive area of the presently known West Antarctic rift system interpreted as caused by subglacial volcanic rocks. These early aeromagnetic surveys later combined with radar ice sounding in 1978-79 and 1990-97 defined this area as >500,000 km^2. These anomalies range from 100->1000 nT as observed ~1 km over the 2-3 km thick moving ice. Behrendt et al, (2005) interpreted these anomalies as indicating >1000 "volcanic centers." requiring high remanent magnetizations in the present field direction. Detailed aeromagnetic and radar ice sounding surveys since 1990 have shown that >80% of these anomaly sources at the bed of the WAIS have been modified by the moving ice into which they were injected requiring a younger age than the WAIS (about 25 Ma). Behrendt et al., (1994; 2007) conservatively estimated >1 x 10^6 km^3 volume of volcanic sources to account for the area of the "volcanic center" anomalies and suggested the presence of a large igneous province (LIP) if this volume was intruded within a time interval of 1-10 m.y.

Mt Erebus, (<1 Ma) Mt. Melbourne, (<0.26 Ma), and Mt. Takahae (<0.1 Ma) are examples of exposed active volcanoes in the WAIS area, but the great volume of volcanic centers is buried beneath the WAIS. If only a very small percentage of these >1000 volcanic magnetic-anomaly sources are active today, or in the recent past, in the drainage area of the WAIS, subglacial volcanism may have a significant effect on the dynamics of the WAIS. Interpreted active subglacial volcanism is revealed by aerogeophysical data reported by Blankenship et al., (1993), and Corr and Vaughan, (2008), who raised the question of possible volcanic effects on the regime of the WAIS. Vogel and Tulaczyk (2006) argued that subglacial volcanism may play a "crucial roll" in WAIS stability, In my presentation I will review the geophysical evidence acquired from the IGY to the IPY, and conclude that even if there is a very low probability, future effects on the stability of the WAIS should not be ignored, as the rapid changes observed in the past 20 years resulting from global warming, could be accelerated by volcanism.