PS5.10

Late Miocene evolution of the Minna Bluff Volcanic Complex, Ross Embayment, Antarctica

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Minna Bluff is a 45-km-long, 5-km-wide late Miocene alkaline volcanic peninsula that extends SE into the Ross Ice Shelf from the Mt. Discovery stratovolcano. Phonolite and tephriphonolite lavas and domes are exposed in cliff exposures and along the crest of Minna Hook, at the eastern end of Minna Bluff. There is a trend toward exclusively mafic rocks along the central and western areas of Minna Bluff. Mapping and 40Ar/39Ar dating of volcanic sequences suggest that Minna Hook emerged as island in the Ross Sea at about 12 Ma and progressively expanded westward from 8 to 6 Ma. The peninsula influenced regional paleogeography as a topographic barrier to ice flow directed into McMurdo Sound and likely as a pinning point for the terminus of the Ross Ice Shelf. Minna Hook cliff sections include stratigraphic alternations between rocks erupted in subaerial and subaqueous conditions; these sequences are interpreted to represent syneruptive interactions between lava flows and a local ice cap. The upper parts of the Minna Hook sections resemble south-facing exposures along McIntosh Cliff sequences, in being dominated by subaerial lava, breccia, and vent complexes and lacking subaqueous volcanic lithofacies, sedimentary rocks, and unconformities. More than 50 partially eroded, subaerially erupted domes and cinder cones were mapped and are preserved on the bluff top.

Widespread, undulating unconformities mantled by glacial and fluvial sediments exposed near the base of the sequences record broader scale Ross Ice Sheet events between 10.46 and 10.31 Ma and between 9.81 and 9.46 Ma. The older of these widespread glaciations may correspond to Miocene Isotope Event Mi-6, identified in marine sediment records. Eruptions and glacial overriding events at Minna Bluff occurred over the same time interval as sedimentation at the Andrill MIS and SMS core sites.