

Zircon fission-track analysis of sediments from the James Ross Island and Seymour Island, Antarctica

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The Antarctic Peninsula is one of the major crustal blocks of West Antarctica between southern South America and East Antarctica, and separated from South America in Miocene. James Ross Island (approximately 64S and 57W) is a large island near the northeastern end of the Antarctic Peninsula and Seymour Island is a small island about 20 km southeast of James Ross Island. James Ross Basin contains one of the thickest and most complete Cretaceous sedimentary successions anywhere in the Southern Hemisphere. James Ross Basin is a back-arc basin linked to the early stages of Gondwana break-up as a result of subduction of the proto-Pacific ocean crust beneath the southern margin of Gondwana. The basin is filled by a sequence of arc-derived clastic and volcanoclastic marine sediments subdivided into three principal lithostratigraphical groups (Gustav, Marambio, Seymour Island). The basal Gustav Group represents stratigraphically oldest deep-water sediments, while Marambio and Seymour Island groups are finer-grained and shallow-water sediments. Age of sedimentation suggests an early Cretaceous age for Gustav Group; the Marambio Group is generally taken to be Santonian-Danian in age and the Seymour Island Group as Eocene/earliest Oligocene.

We dated seven samples from the northern coast of James Ross Island (Gustav Group, Marambio Group) and four samples from Seymour Island, and obtained 11 sets of the data of FT lengths and ages using zircon crystals extracted from them. As a result, Gustav group from James Ross Island has two potentially clusters of ages having less than 100 Ma and more than 130 Ma. Zircon FT ages from Marambio Group of James Ross Island and Seymour Island are consistently older (ca. 120-200 Ma) than previous group. We estimated time-temperature history using the MonteTrax program for the zircon FT data. As a result, Gustav group was stable until approximately 30 Ma, and then uplifted rapidly (6-10 degC/Ma) to the present. Marambio Group was stable until 120-80 Ma, then uplifted gradually, and finally 7-8 degC/Ma from 30-20 Ma to present. The uplifting of Seymour Island began (1-3 degC/Ma) after the stability period at 250 degC until 60-90 Ma.

T-t modeling results of our samples reveal two areas with similar time-temperature histories in James Ross Basin. Different timing and differences are in erosional rates that are interpreted as earlier uplift in southeastern parts of James Ross Basin (Seymour Island; Late Cretaceous) comparing to northern part of the basin (James Ross Island) in Paleocene/Eocene.