STRUCTURAL EVOLUTION OF THE DAYMAN DOME METAMORPHIC CORE COMPLEX, EASTERN PAPUA NEW GUINEA

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The ~750 km^2 Dayman dome of the Late Cretaceous Suckling-Dayman massif, eastern Papua New Guinea, is a domed landform that rises to an elevation of 2850 m. The northern edge of the dome is a fault scarp >1000 m high that is now part of an active microplate boundary separating continental crust of the New Guinea highlands from continental and oceanic crust of the Woodlark microplate. Previous work has shown that a parallel belt of eclogite-bearing core complexes northeast of the Dayman dome were exhumed from up to 24–28 kbar in the last few Myr. The remarkably fresh and lightly eroded scarp of the Dayman dome exposes shallowly-dipping mylonitic (S1) metabasite rocks (500 m thick) on the northern flank of Mount Dayman. Field relationships near the base of this scarp show a cross cutting suite of ductile and brittle meso-structures that includes: (i) rare ductile S2 folia with shallowly ESE-plunging mineral elongation lineation defined by sodic-calcic blue amphibole; (ii) narrow steeply-dipping ductile D2 shear zones; and (iii) semi-brittle to brittle fault zones. Pumpellyite-actinolite facies assemblages reported by previous workers to contain local aragonite, lawsonite and/or glaucophane are found in the core of the complex at elevations greater than 2000 m. These assemblages indicate peak metamorphic pressures of 6–9.5 kbar, demonstrating exhumation of the core of the Dayman dome from depths of 20-30 km. The S1 metamorphic mineral assemblage in metabasite includes actinolite-chlorite-epidote-albite-quartz-calcite-titanite, indicative of greenschist facies conditions for the main deformation. New mineral equilibria modeling suggests that this S1 assemblage evolved at 5.9–7.2 kbar at approximately 425 °C. Modeling variable Fe^{3+} indicates that the sodic-calcic blue amphibole (D2) formed under higher oxidation state compared with the S1 assemblage, probably at less than 4.5 kbar. A SE-dipping, Mio-Pliocene sedimentary sequence (Gwoira Conglomerate) forms a hangingwall block juxtaposed by low-angle fault contact with the metabasite footwall. Prehnite-bearing D3 brittle fault zones separate the two blocks and likely accommodated the final exhumation of the S1 greenschist facies assemblage in the footwall. These results indicate that the extensive Mt Dayman fault surface coincides with a domed S1 greenschist facies foliation that was last active at > 20 km depth. Exhumation of this foliation must therefore be controlled by brittle faults of the active microplate boundary that are largely not observed in the study area. The structural record of the final exhumation of the Dayman dome to the surface was likely lost as a result of erosion, poor exposure, or wide spacing of semi-brittle to brittle fault zones.