A PIVOTING MICROPLATE MODEL FOR SUBDUCTION EVERSION AND EXHUMATION OF UHP TERRANES

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In eastern Papua New Guinea (PNG), Pliocene exhumation of high and ultrahigh-pressure (HP–UHP) rocks is intimately linked to a pivoting microplate. The present day tectonic setting of this region is the result of rapid, oblique convergence between the Australian (AUS) and Pacific plates. Counter-clockwise (CCW) rotation of the Woodlark microplate (WLK) relative to the AUS plate within this larger tectonic framework led to the inception and westward propagation of sea floor spreading (SFS) in the Woodlark Basin beginning ca. 6 Ma. West of the rift tip, metamorphic core complex formation is associated with rapid exhumation of Late Miocene–Pliocene HP–UHP metamorphic rocks formed during prior subduction. Tectonic reconstructions of the AUS–WLK plate boundary zone in eastern PNG suggest the SFS system exploits the former subduction thrust and are in accord with the documented southeastward transition from convergence, to sinistral strike-slip faulting, to divergence. Plate tectonic based calculations suggest that removal of the upper plate (WLK) via CCW rotation and synchronous exhumation of lower plate rocks from beneath mylonitic shear zones is sufficient to exhume rocks from > 100 km depths.

The microplate rotation model provides a testable hypothesis by which to assess its applicability to older UHP terranes. Evidence for microplate rotation should be recorded in along-strike structural transitions as predicted and documented in eastern PNG. Geographic polarity of the transition is dependent upon the clockwise v CCW rotation of the upper plate, while the shear sense in the transitional strike-slip zone is a function of relative plate motions. The model also predicts generalized spatial patterns of stretching lineations and metamorphic grade as seen in PNG. Increasing pressure gradients from south to north as well as from west to east may be associated with an overall W-plunging antiform. Regional patterns of stretching lineations reflect changing flow patterns consistent with rotation.

We propose that the Qinling–Dabie terrane in eastern China may be an ancient example of a UHP terrane exhumed during subduction zone eversion associated with a pivoting microplate. The orogen is characterized by: 1) a W-plunging, antiformal dome associated with pressure gradients that increase from south to north as well eastward along strike; 2) stretching lineations that record changing flow patterns consistent with rotation; 3) the existence of a contemporary along-strike transition from transpression in the Qinling to extension in the Dabie Shan; and 4) available paleomagnetic data suggest ca. 60 degrees of relative rotation between the North and South China blocks.