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Subduction of Basement Relief off Central Java: Geological Indications for Subduction Erosion

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A limited number of geological and tectonic key factors appear to favour and guide tectonic erosion over subduction accretion or intermediate non-accretive styles. These include convergence rates exceeding 6 cm/a, low (< 1 km) sediment input in the trench, and seafloor roughness. Effective erosion is foremost controlled by the collision of bathymetric elevations with the margin. Even though collision of large topographic units is episodic and short-lived along most margins, its influence on the evolution of that margin is profound as it governs the rates of material transfer. Erosion may either occur along the front of the margin or along the base of the forearc wedge. A high convergence rate, starved trench and intense seafloor relief is observed along the central to eastern Java margin, indicating erosive processes along this otherwise accretionary subduction zone.

The Sunda margin, including the Sumatra and Java sectors, is regarded as a classical example for an accretionary type margin. Along the Sumatra sector, the high rate of sediment input to the trench and the extremely high ratio of accreted to subducted sediment forms one of the world's largest accretionary systems. The Java sector, however, experiences a steadily declining sediment supply in correlation with an increasing distance from the Ganges-Brahmaputra Delta. Off western Java, where the trench currently carries app. 1.3 km of sediment fill, a continuous and homogeneously developed frontal accretionary prism and outer forearc high have evolved in conjunction with a mature forearc basin. The lateral extent of the frontal accretionary prism, the outer forearc high and the forearc basin is abruptly disrupted around 110˚E off central Java. No distinct frontal prism and prolonged outer forearc high are recognizable along the central and eastern Java sectors and a continuous forearc basin is not present. Here, the outer forearc high is characterized by isolated bathymetric highs instead of forming an unbroken ridge, as it exists in the western Java sector. An active frontal ac-

cretionary prism neighbouring the outer forearc high, as recognized off western Java and off Sumatra, has not coherently developed off central and eastern Java, where the trench is devoid of any sediment infill.

Subduction processes off central and eastern Java are dominated by the collision of the oceanic Roo Rise with the forearc between 111˚E and 115˚E. The Roo Rise represents a little investigated oceanic relief feature, which forms an irregularly shaped broad swell dotted with isolated morphological summits. The collision of the Roo Rise with the margin causes a displacement of the trench and deformation front to the north. Here, the subduction of oceanic basement relief has largely destroyed the accretionary features. A dense seamount population and intense pattern of plate-bending induced normal faults tremendously increases the roughness of the seafloor entering the trench off central and eastern Java.

Erosion of the upper plate is best documented by the broad retreat of the Java trench and deformation front in the projection of the Roo Rise. Between 110˚E and 115˚E, the trench is deflected northward by approximately 50-60 km from its normal curvature trend. The irregular trend of the deformation front along this segment results from numerous indentations arising from local erosive processes caused by seamount collision. In addition to the landward retreat of the forearc structures, a continuous steepening of the lower slope along the forearc is observed, resulting from the removal of material during erosive processes. Thus in global taper diagram compilations the central Java margin clearly maps in the erosive regime.