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Can the Northern Borneo Mélange Help Us Understand the End of the Subduction?

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Sabah has experienced collision event following the end of the Proto-South China Sea subduction. The collision also resulted in a fold-and-thrust-belt, tremendous uplift particularly near Mt. Kinabalu, and gravity tectonics involving mass transport deposits, principally in the offshore Palawan and NW Borneo. In addition, this region is also known for the extensive occurrence of mélange, although their formation and process are unknown and still debated. In this study, we observe the structure and sedimentation process on field data and seismic lines correlated with DTM. The overall structure is controlled by the underthrusting of continental basement covered by carbonate, under a wide wedge which abuts on a strong reflective buttress which crops out in Kudat and Banggi regions. These subduction features are sealed by successor basins to the west and by a complex system of circular basins which rest on a lithology marked by chaotic seismic facies.

Onshore field observation shows the buttress is composed of ultramafic rocks and a large amount of pillow basalts and radiolarites which appeared severely sheared. The wide shear-bands exhibits large phacoid-shape blocks of basalt and radiolarite. Overlying these deformed units are the circular basins. However, the basins often rest on mélange composed of clay-supported matrix engulfing plurimetric blocks of basalts, radiolarite and sandstone which also often bear similar phacoid shape. The subsurface structure of these mélange demonstrates that chaotic facies is covered by the well-stratified facies, and is expelled to the surface as a diapir-like feature. The overlying strata are deformed into small-scale folds. The location of exposure the diapir material coincides with the area of mélange found in the field. We suspect the mechanism of exposing the mélange is due to an unstable condition, during which the dense quartzitic material of the circular basins, overloaded the mélange and forced it to the surface.

These observations are part of a picture which illustrates the tectonic setting of the end of subduction and the post-subduction in the northern Borneo. The ophiolite and radiolarite were thrusted, uplifted to the surface and eroded into successor basin in which the clayey fraction of the oceanic sequence was reworked together with the tectonics blocks. This unconsolidated poorly viscous material was later subject to gravity tectonics and mild extension.