
Relationship of gabbro and pillow lavas in the Lupar Formation, West Sarawak: implications for interpretation of the Lubok Antu Mélange and the Lupar Line

N.S. HAILE¹ & S.K. LAM²

¹PETRONAS Petroleum Research Institute

²Geological Survey Department, Kuching, Sarawak

The Lupar Line is generally agreed to be a major suture which has resulted from plate movements that largely determined the Cretaceous to Paleogene history of northern Borneo. Never-the-less, there remain many uncertainties regarding the relationship of the various belts and rock types that have been distinguished. Most of the many attempts to reconstruct the history of Borneo and the South China Sea involve the incorporation of a model of the nature and timing of events along the Lupar Line. Thus new factual observations in this area are of regional significance.

The excellent geological map by the Survey Department (D.N.K. Tan, 1979, Report 13) shows a series of NW-SE or WNW-ESE belts in the Lupar Valley, which are, from north to south:

Belaga Formation, Layar Member (part of Rajang Group):

Thick flysch succession: slaty to phyllitic argillite, metagreywacke sandstone. Bathyal, probably distal turbidites. Intensely folded. Upper Cretaceous.

Lupar Formation:

Flysch succession: greywacke, slaty argillite and mudstone. Bathyal, probably proximal turbidites. Strongly folded, with slumping. Upper Cretaceous.

Included in this belt are elongated bodies of basic lava (including pillow lava) and gabbro.

Lubok Antu Mélange:

Typical *mélange*, with blocks, lenses, boulders, pebbles and granules of sandstone, radiolarian chert, basic igneous rocks, and limestone, in a sheared argillaceous matrix. Tectonic *mélange*. Age of blocks ranges from Lower Cretaceous to lower Eocene; the matrix is in part at least Eocene.

Silantek Formation:

Shale, mudstone, sandstone, and coal. Shallow marine to fluvial and lacustrine. Upper Eocene to ? Miocene.

The gabbro and pillow lavas within the Lupar Formation have been interpreted as faulted-in slices of oceanic crust, and by implication as older than the Lupar.

A brief examination of quarries and excavations made in the areas of dams and quarries constructed for the Batang Ai Hydroelectric Project has shown that at least some of the gabbro within the bedded flysch typical of the Lupar Formation is intrusive, and pillow lava interbedded, contrary to the view that they represent

older oceanic crust emplaced tectonically as faulted slices with the Lupar. The evidence for this is:

- a) Unfaulted contacts of concordant sills of gabbro within the formation, which is thermally metamorphosed for at least 50 m at the contact.
- b) Pillow lavas in contact with and concordant with the Lupar Formation along an unfaulted contact.

This implies that the lavas are contemporaneous with the Upper Cretaceous Lupar Formation, and at least some of the gabbro is probably also of the same age, although it could be younger, if unrelated to the lavas.

Consideration of this evidence, and of the results of recent mapping in adjacent parts of Kalimantan to the south, suggests that:

- i) the gabbro and pillow lava are not oceanic crust, but intrusive into and extrusive within the Lupar Formation;
- ii) the junctions between the Lubok Antu Mélange and the Lupar Formation, and that between the Lupar and Layar Formation, may be major sutures, whereas the Lupar Valley itself may only be a fault zone within a broad mélange belt that extends south beneath the Silantek Formation, which forms the northern rim of the Ketungau Syncline.