

Shyok Suture Zone, N Pakistan: Late Mesozoic-Tertiary Evolution of a Critical Suture Separating the Oceanic Ladakh Arc from the Asian Continental Margin

1 Alastair H.F. Robertson 2 ALAN S. COLLINS
1 Department of Geology and Geophysics
University Edinburgh
West Mains Road
Edinburgh
EH9 3JW
UK

Tectonics Special Research Centre
Department of Applied Geology
Curtin University of Technology
GPO Box U1987
Perth
WA 6845
Australia

Abstract

The Shyok Suture Zone (Northern Suture) of N Pakistan is an important Cretaceous-Tertiary suture separating the Asian continent (Karakoram) from the Cretaceous Kohistan-Ladakh oceanic arc to the south. In previously published interpretations, the Shyok Suture Zone either marks the site of subduction of a wide Tethyan ocean, or represents an Early Cretaceous intra-continental marginal basin along the southern margin of Asia. To shed light on alternative hypotheses, a sedimentological, structural and igneous geochemical study was made of a well-exposed traverse in N Pakistan, in the Skardu area (Baltistan). To the south of the Shyok Suture Zone in this area is the Ladakh Arc and its Late Cretaceous, mainly volcanogenic, sedimentary cover (Burje-La Formation). The Shyok Suture Zone extends northwards (ca. 30 km) to the late Tertiary Main Karakoram Thrust that transported Asian, mainly high-grade metamorphic rocks southwards over the suture zone.

The Shyok Suture Zone is dominated by four contrasting units separated by thrusts, as follows: 1. The lowermost, Askore amphibolite is mainly amphibolite facies meta-basites and turbiditic meta-sediments interpreted as early marginal basin rift products, or trapped Tethyan oceanic crust, metamorphosed during later arc rifting. 2. The overlying Pakora Formation (structurally lowest), is a very thick (ca. 7 km in outcrop) succession of greenschist facies volcanoclastic sandstones, redeposited limestones and subordinate basaltic-andesitic extrusives and flow breccias of at least partly Early Cretaceous age. The Pakora Formation lacks terrigenous continental detritus and is interpreted as a proximal base-of-slope apron related to rifting of the oceanic Ladakh Arc; 3. The Tectonic Melange (<300 m thick) includes serpentinitised ultramafic rocks, near mid-ocean ridge-type volcanics and recrystallised radiolarian cherts, interpreted as accreted oceanic crust. 3. The Bauma-Harel Group (structurally highest) is a thick succession (several km) of Ordovician and Carboniferous to Permian-Triassic?, low-grade, mixed carbonate/siliciclastic sedimentary rocks that accumulated on the south-Asian continental margin. A structurally associated turbiditic slope/basinal succession records rifting of the Karakoram continent (part of Mega-Lhasa) from Gondwana. Red clastics of inferred fluvial origin ("molasse") unconformably overlie the Late Palaeozoic succession and are also intersliced with other units in the suture zone.

Reconnaissance further east (N of the Shyok River) indicates the presence of redeposited volcanoclastic sediments and thick acid tuffs, derived from nearby volcanic centres, presumed to lie within the Ladakh Arc. In addition, comparison with Lower Cretaceous clastic sediments (Maium Unit) within the Northern Suture Zone, west of the Nanga Parbat syntaxis (Hunza River) reveals notable differences, including the

presence of terrigenous quartz-rich conglomerates, serpentinite debris-flow deposits and a contrasting structural history.

The Shyok Suture Zone in the Skardu area is interpreted to preserve the remnants of a rifted oceanic back-arc basin and components of the Asian continental margin. In the west (Hunza River), a mixed volcanogenic and terrigenous succession (Maium Unit) is interpreted to record syn-deformational infilling of a remnant back-arc basin/foreland basin prior to suturing of the Kohistan Arc with Asia (75-90 Ma)