

Vakilabad Complex, NE Iran: An Intraplate Oceanic Plateau, Not an Ophiolite

MR. HADI KARIMI¹, HRIPSIME GEVORGYAN¹, LOTHAR RATSCHBACHER¹, FATEMEH NAJMI² AND HAMID HAFEZI MOGHADDAS²

¹Geowissenschaften, TU Bergakademie Freiberg, 09599 Freiberg, Germany

²Ferdowsi University of Mashhad

The Vakilabad complex ('Mashhad metamorphics') in northeastern Iran has been widely debated, with some studies suggesting it represents an ophiolite formed during the closure of the Paleo-Tethys Ocean (e.g., [1]). However, based on recent geological evidence, we argue that the Vakilabad Complex is a fragment of an oceanic plateau formed by mantle plume activity, rather than a classic ophiolite. On the one hand, the absence of key ophiolitic features, such as peridotites, layered gabbros, sheeted dikes, and rocks with MORB-like characteristics, on the other hand, the presence of komatiite with intraplate magmatism, points to a tectonic setting consistent with oceanic plateau formation. A notable and distinct feature that arises from studies of multiple obducted and accreted oceanic plateau remnants is the absence of a sheeted dyke complex [2], which is characteristic of typical ophiolitic sequences. Geochemical data further supports this model, with komatiites and basaltic rocks exhibiting signatures indicative of mantle plume magmatism, rather than the typical MORB signature found in ophiolites. This interpretation is supported by earlier researchers, such as [3]. The Mashhad Complex does not meet the requirements for an ophiolite, by getting a score of less than 6 (score of 2) on [4] grading method. Thus, all evidence is in favor of an oceanic plateau, which is obducted to the Eurasian plate during the closure of the Paleo-Tethys Ocean. Because misidentifications can lead to inaccurate geodynamic models, these findings emphasize the need to distinguish between ophiolites and oceanic plateaus in tectonic reconstructions.

References

- [1] Alavi, M., 1991. Sedimentary and structural characteristics of the Paleo-Tethys remnants in northeastern Iran. *GSA Bulletin* 103, 983-992.
- [2] Kerr, A.C., Mahoney, J.J., 2007. Oceanic plateaus: Problematic plumes, potential paradigms. *Chemical Geology* 241, 332-353.
- [3] Karimi, H., Gevorgyan, H., Ratschbacher, L., Yang, Z., Gerdes, A., Etemadi, A., 2025. Decoding the evolution of Paleo-Tethys: Geochemical and geochronological reinterpretation of the Paleozoic ultra-mafic to felsic rocks in Northeast Iran. *Lithos* 494, 107916.
- [4] Condie, K.C., Stern, R.J., 2023. Ophiolites: Identification and tectonic significance in space and time. *Geoscience Frontiers* 14, 101680.