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Temporal change in stress orientations over SW Saurashtra, Gujarat, Western India: indicators from palaeostress analysis

Naimisha Vanik[1*], Mohamedharoon Shaikh[1], D. M. Maurya[1], Soumyajit Mukherjee[2] and L. S. Chamyal[1]
[1]Department of Geology, The M. S. University of Baroda, Vadodara-390002, Gujarat
[2]Department of Earth Sciences, Indian Institute of Technology Bombay, Powai, Mumbai-400076, Maharashtra

Abstract

The Saurashtra peninsula in Gujarat, western India, also known as the Kathiawar uplift, is a quadrangular SW titled uplifted horst block between three coinciding rift basins viz., Kachchh at the north, Cambay at the east and Narmada at the south. The area is also bounded by major faultslike North Kathiawar Fault (NKF) at N, extension of West Coast Fault (WCF) at W, extension of Narmada-Son Fault (NSF) at S and Western Cambay Basin Margin Fault (WCBMF) at E trending NE, NW, ENE and NNE respectively.The peninsula is affected by major tectonic events that occurred after the breakup of Gondwanaland i.e., from Middle to Late Jurassic till the Late Cretaceous, evolving rift basins, reactivation of tectonic trends and numerous intrusions. Most part of Saurashtra comprises rocky landmass of Upper Cretaceous-Eocene Deccan basalts fringed by patches of Tertiary sediments, Quaternary miliolites and coastal deposits. Our study around Rajula in SW Saurashtra includes a previously unmapped, ~E-W trending sub(vertical) brittle fault plane (Katar Fault) with horizontal, inclined and subvertical slickensides and Miocene limestone of Gaj Formation near Kadiyali with two prominent sets of joints. Based on the attitudes of the fault plane and striations (total 46 fault plane data), we analysed paleostress using three different software, T-Tecto, WinTensor and FaultKin. Furthermore, 65 joint plane data from the Tertiary rocks were also used to analyse paleostress using T-Tecto. The maximum horizontal stress (SH_{max}) of neotectonic joints in Quaternary miliolite deposits trending NE-SW (N 45º E)is previously indicated by Khadkikar(2002). Also, one of the major stress trends plotted by drilling two wellsin offshore zone in the Kutch-Saurashtra shows NNE (N 7º E) trend (Kundan et al., 2017). We compared our present paleostress analysis of fault-slip dataand Tertiary joint data with previously detected SH_{max} trend of neotectonic joint data and Saurashtra offshore data.Our fault-slip analysis shows stress ratio of up to 0.2 indicating transpression, and a SE SH_{max} deduced using T-Tecto. The SH_{max} trend from the Katar Fault in Deccan Trap (Vanik et al., 2018) and theTertiary joint sets show up to 46ºand 39º rotation respectively when compared with data from the offshore region (Kundan et al., 2017). We suggest rotation of SH_{max} trend in SW Saurashtra from N 53º Eto N 45º Ethat the area underwent anticlockwise (8º) rotationfrom Early Cretaceous till present.This compares well with the presently N23º E mean orientation of SH_{max} of the Indian plate that is undergoing deformation under compression.

References

Khadkikar, A. S. (2002). Late Quaternary neotectonic joints: Confirmation of the connection between jointing and contemporary tectonic stress. Geophysical Research Letters *29*(11).

Kundan, A., Desai, A., Bahuguna, S., Talreja, R., Nakhle, A., Zayyan, M., Narayanan, S., Tewari, P., Purohit, S. &Basu, J. (2017). Revolutionary Drilling Performance in Challenging HPHT and Basaltic Environment of Kutch & Saurashtra Exploration Field. In *SPE* Oil and Gas India Conference and Exhibition. Society of Petroleum Engineers.

Vanik, N., Shaikh, M., Mukherjee, S., Maurya, D. M.&Chamyal, L. S. (2018) Post-Deccan trap stress reorientation under transpression: Evidence from fault slip analyses from SW Saurashtra, western India. Journal of Geodynamics 121, 9-19.