Lava effusion in Ziarat, Balochistan, Pakistan

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The geological and tectonic legacy of Balochistan has endowed it with massive mountain belts, arcs, syntaxes as characterized by severe bending of the mountain belts from the ongoing convergence of the Indo-Pakistan, Eurasian and Arabian plates. The Province is a seismically active and tectonically unstable region. The eruptive/effusive vent activity on 27th January 2010 at the Tor Zawar Mountain at Sari, Ziarat is a unique testimony substantiating the earlier risk/hazard findings for the area, as no previous post-Tertiary volcanic activity has ever been reported earlier in the history of the Indo-Pak subcontinent. Integrated geological, and geophysical surveys were undertaken during January-April 2010 to investigate the short lived toothpaste lava to map, detect, and delineate the changes resulting in the sub surface lithological and structural disposition at the vent site. A holistic approach is adopted for the interpretation and analyses of the total magnetic field intensity, electrical resistivity, and ground penetration radar surveys along with the geology, petrography and the geochemical analyses of the molten material, which are presented along with a probable model.

The synthesis of the magnetic, resistivity soundings, and profiling and ground penetration radar survey indicate the presence of highly magnetic dual lobe sources, resistive, and prominent reflectors from the radar soundings in and around the vent site. The resistivity pseudo sections delineate the lateral and vertical molten flows which have apparently solidified at shallow depth. The GPR mapping due to ideal ground conditions has optimum penetration with high definition reflector topography, internal scatterers and hyperbolas. The radar imaging explicitly shows folding of the overlying fine-grained clastics whereas fracturing in the compact, hard, and brittle rock units of compact gravels/limestone and volcanics due to the pressure exerted by the intrusion.

The geological map of the study area (latitude 30º 15´ to 30º 45´ longitude 67º 15´ to 67º 45´) characterizes the presence of older volcanic rocks which are remnants of past volcanic episodes. This makes it rather difficult to further resolve the present research findings that whether the subsurface discordant features/intrusive mapped are the result of solely the present day volcanic activity or the resultant effect incorporating both the older volcanics remelting and fusion with the present day ascending hydrothermal solution/magma. However, based on the present survey the lava effusion appears as an interactive play, and involvement of the older volcanics, ascending magma from depth and dual tectonic-magmatism generating the eruptive activity. The epicentral/focal locations, and migration of the past, and present events in the area strongly suggest the role of regional tectonics and a positive connectivity of the weaker Sibi re-entrant, Quetta-Kalat fault zone and the Quetta transverse zone.