How pre- and syn-Hormuz formations were incorporated into the Zagros salt diapirs and reached the surface?

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The southern Fars region of Iran is a classical and very well-studied area of salt tectonics for more than a century. Our study area is located in the “Simply Folded Belt” of the Zagros Mountains, including the nearby offshore of the Persian Gulf, and has a large number of well-known salt diapirs. These diapirs, composed of the infra-Cambrian Hormuz evaporites, have a surface diameter between 2-12 km and may extend vertically beneath the surface down to anywhere between 6-12 km.

In outcrop, the most striking aspect of these diapirs is the very large proportion of non-evaporitic rocks embedded within the evaporites. Also, these extraclasts (or megaclasts) are sometimes very large, reaching even the kilometer scale. We interpret their present-day dominance and ubiquitous “crowding” in the outcropping apex of any given diapir as quite misleading as to their overall compositional contribution to these salt bodies. In our view, their seemingly large proportion in the internal make-up of the diapirs should be attributed to the preferential preservation of non-evaporitic rocks exposed on the surface. We argue that the real proportion of the overall non-evaporitic rocks within a typical Hormuz diapir could be as low as 1-2%, but certainly not more than 10%. Nevertheless, given their typical lithologies composed of crystalline basement, Eocambrian carbonates and sandstones with very high seismic velocities on the order of 5,000-5,500 m/s, the megaclasts may make the “dirty” salt faster than the typical 4,500 m/s velocity of a typical “clean” rock salt sequence. These distinct crystalline and poorly dated Lower Paleozoic carbonate and clastic rocks found in the diapirs appear to have analogue formations outcropping only very far from the study area, like in Central Iran.

Importantly, as reported by others earlier, we have not found any evidence for the presence of post-Hormuz (i.e. post-Cambrian) host-rock lithologies incorporated into the diapiric material. Therefore, the strikingly selective nature of the extraclast lithologies within the diapiric bodies points to their original intra-Hormuz stratigraphic position. During Cenozoic diapirism, these infra-Cambrian Hormuz “stringers”, also including some pre-rift basement lithologies, were selectively incorporated into the ascending evaporite material as megaclasts and were carried to the surface from large depth. Therefore, one of the important conclusions of our study is that the various
Hormuz intra-salt lithologic units must have deposited in a broad, wide-rift extensional setting.