
Diapir flaring and a new mechanism of subsalt folding in flanking sediments

Antonio Teixell*^{†1}, Maria Nikolinakou², Michael Hudec³, Pierre Labaume⁴, and Naiara Fernández⁵

¹Departament de Geologia, Universitat Autònoma de Barcelona, 08193 Bellaterra – Espagne

²Bureau of Economic Geology, Jackson School of Geosciences, The University of Texas at Austin, Austin, TX, 78713-8924 – États-Unis

³Bureau of Economic Geology, Jackson School of Geosciences, The University of Texas at Austin, Austin, TX, 78713-8924 – États-Unis

⁴Géosciences Montpellier – Université de Montpellier – France

⁵German Research Centre for Geosciences, D-14473, Potsdam – Allemagne

Résumé

While the mechanisms of stratal deformation around steep diapirs or low-angle salt sheets are relatively well understood, the processes operating in flaring diapirs or in the inclined, overhanging segments that connect feeder stems with sheets remain largely unaddressed. We propose a new folding mechanism during diapir lateral expansion (flaring), based on field observations and numerical modeling. Well-exposed geometries of salt-sediment interaction in both subsalt and suprasalt sections adjacent to a Keuper sheet in the Moroccan High Atlas allow for the reconstruction of the evolving salt structure and provide insights into modalities of deformation related to salt flaring.

The Idalioun salt sheet of the Central High Atlas is currently tabular and flat-lying, but it cuts upsection across an inclined, thick subsalt stratigraphy with a regional ramp angle of 30-40°, indicating that it originated as a wedge-shaped salt flare. We interpret that continuous subsidence and minibasin-scale folding rotated the salt flare into its current subhorizontal sheet geometry.

At the decametric (diapir-margin) scale, the sheet overlies a strikingly continuous recumbent syncline, whose upper limb forms an overturned collar 60-80 m thick. The absence of halokinetic sequences or stratal thinning suggests that drape folding was not the dominant deformation mechanism in this structure. Moreover, none of the known mechanisms of salt sheet advance (e.g., frontal rolling or basal shear) explains adequately the subsalt deformation observed at Idalioun.

An evolutionary, finite-element numerical model built in the Elfen platform simulated the deformation of basin sediments in response to the evolving shape of a salt dome transitioning into a salt sheet. In the intermediate flaring diapir stage, the widening diapir loaded the adjacent basin sediments, causing post-depositional recumbent folding that closely replicates the natural example from the Atlas. The lateral expansion of the salt induced a combination of shear and layer rotation in the surrounding wall rocks, leading to progressive layer upturning and eventual overturning. The mechanism here illustrated suggests that deformation

*Intervenant

†Auteur correspondant: Antonio.Teixell@uab.cat

observed beneath allochthonous salt sheets may actually record precursor phases of diapir flaring -an inherited structural imprint that should be carefully considered when interpreting subsalt structures in salt basins.

Mots-Clés: salt tectonics, diapir flaring, folding, Moroccan Atlas, Numerical modeling