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Style and timing of salt tectonics in the Dniepr-Donets Basin (Ukraine): implications for triggering and driving mechanisms of salt movement in sedimentary basins

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The Ukrainian Dniepr-Donets Basin (DDB) is a Late Palaeozoic intracratonic rift basin, with sedimentary thicknesses up to 19 km, displaying the effects of salt tectonics during its entire history of formation. Salt movement in the DDB began during the Devonian syn-rift phase of basin development and exerted controls on the later distribution of salt structures though the geometry of basement faults is not directly responsible for the regular spacing of salt structures. Post-rift salt movements in the DDB occurred episodically. Episodes of salt movement were triggered by tectonic events. Extensional events that induced salt movement were "thick-skinned" rather than "thin-skinned". Most overburden deformation related to salt movements is ductile regardless of sedimentary bulk lithology and degree of diagenesis, while the deformation of sedimentary cover in areas where salt is absent is mainly brittle. Buoyancy, erosion, and differential loading all played a role in driving halokinesis once tectonic forces had pushed the salt-overburden system into disequilibrium; among these factors, erosion of overburden above growing salt structures acted as a key self-renewing force for development of salt diapirs. Very high sedimentation rates (related to high post-rift tectonic subsidence rates), particularly during the Carboniferous, were able

to bury pierced diapirs and to load salt bodies such that buoyancy, erosion, and differential loading forces eventually became insufficient to continue driving diapirism – until the system was perturbed by the ensuing tectonic event. In contrast, some salt anticlines and diapirs developed continuously during the entire Mesozoic because of much-reduced tectonic subsidence rates during this time.

Rheology of natural materials was applied to model quantitatively the mechanism of trap and salt structure formation. The dynamic model of overburden is characterised by the presence of internal block structure. The overburden can be separated or crushed by external load. Thus, the salt overburden is a brittle-elastic medium that is frequently used on physical simulation of salt tectonics. The modelling results show that buoyancy, erosion, and differential loading all play a role in driving halokinesis once tectonic forces have pushed the salt-overburden system into disequilibrium; among these factors, erosion of overburden above growing salt structures acted as a key self-renewing force. The results are in accordance with peculiarities of salt diapirsm in the DDB.