Deformation related to Carboniferous salt tectonics, western Cape Breton, Nova Scotia

John P. Brown[1], Ian Davison[2], Ian Alsop[2] and Martin R. Gibling[1]
[1]*Department of Earth Sciences, Dalhousie University, Halifax, Nova Scotia B3H 3J5, Canada*
[2]*Department of Geology, Royal Holloway University of London, Egham, United Kingdom, TW20 0EX*

Within western Cape Breton several diapiric structures are exposed as coastal outcrops or imaged on seismic sections. The diapiric structures vary in height from 1.5 to 4.3 km, with height being proportional to the age and maturity of the salt structure. Diapirism uplifted overlying middle and upper Windsor Group sediments as a carapace or cap rock above lower Windsor halite and deformed the adjacent Upper Carboniferous overburden into diapir drag zones. Within the diapirs, middle and upper Windsor strata are folded into kilometre-scale curtain folds with sub-vertical fold axes. Meso- and micro-scale parasitic folds are tight to isoclinal with steeply plunging fold axes. Deformation within the diapiric structure is always asymmetric, with strain increasing gradually towards the diapir/overburden contact zone (peripheral shear zone). Middle and upper Windsor gypsum units have been mylonitized and preserve a sub-vertical foliation, while more competent evaporite and thin limestone lithologies within gypsum mylonites are boudinaged. Thick upper Windsor limestones are used as marker horizons and show extremely variable deformation related to position within the diapir. Limestones within the diapir interior show little deformation other than folding, whereas limestones which intersect the peripheral shear zone are either fragmented into metre-scale blocks within gypsum mylonite, or completely disseminated into gravel sized particles within gypsum mylonite. Inverness Formation sandbodies and Port Hood Formation siltstones and mudstones are exposed within diapir drag zones in continuous sections up to 600 m in length. The thick (~100 m), competent, Inverness Formation sandbodies preserve pervasive conjugate joint sets, granulation seams, flexural slip and extensional faults. At the diapir/overburden contact, deformation is such that the sandbody has been completely brecciated. Deformation of the sand bodies is restricted to within 250 m of the diapir. The relatively incompetent silts and muds of the Port Hood Formation preserve a fundamentally different deformation style. Strain is accommodated primarily by two generations of extensional faults; the first formed early and have been passively rotated, maintaining a high angle to bedding, the second formed late and dip parallel to steeply inclined drag zone strata. Within 250 m of the peripheral shear zone the extensional faults strike at 90° (orthogonal) to the diapir, while between 250 m and 500 m away from the peripheral shear zone the extensional faults strike parallel (tangential) to the diapir. The change in fault orientation can be attributed to a re-orientation of the stress field probably related to diapir-induced stress.