The presence of salt has a major control on the tectonic evolution of sedimentary basins, because of the rheological contrast with the surrounding sediments. In addition, evaporites have a strong control on fluid flow in a sedimentary basin, because of their very low permeabilities and ductility. Although salt is widely regarded as a perfect seal, it can become permeable for one- or two-phase fluids under certain conditions of fluid pressure, temperature and differential stress. We present microstructures of Ara salt from the deep subsurface (3–7 km) of the South Oman Salt Basin (SOSB) and from three surface-piercing salt domes of the Ghaba Salt Basin. Both sub-basins form the subsurface of interior Oman and belong to the Late Neoproterozoic to Early Cambrian salt belt, which stretches from Oman to Iran (Hormuz Salt). In the subsurface salt, the occasional presence of primary (syn-genetic) chevron crystals indicates incomplete dynamic recrystallization and suggests shallow hypersaline brine pool origin for the salt succession. Those crystals show fluid-filled grain boundaries and up to 200 micrometer-sized subgrains, pointing to dislocation creep processes associated with fluid-assisted grain boundary migration as the dominant deformation mechanisms during burial and diapirism. Some of the salt cores derive from the direct vicinity of isolated intra-salt carbonate reservoirs and show a black staining by the presence of solid bitumen, which is formed out of oil. The pathways for oil flow in halite can be along zones of diffuse grain boundary dilatancy. The main criterion for this to occur is the presence of near-lithostatic fluid pressures, which allow a dramatic increase in permeability. In the surface-piercing salt, no primary microstructures were found, suggesting that the salt fabric is completely recrystallized during extrusion or at the surface. Fibrous microstructures indicate that solution-precipitation creep was an active deformation mechanism during salt extrusion and/or at the surface. Using subgrain size palaeo-piezometry, the maximum past differential stresses for the subsurface salt is less than 2 MPa and up to 5 MPa for the surface-piercing salt. This stress difference is explained by higher stresses in the extrusion canal of the diapir. The results show that we can infer different deformation mechanisms from different tectonic settings of a salt diapir. Using data of laboratory deformation experiments, i.e. flow laws, we can implement our findings into models of salt tectonics to take the rheological behaviour into account.