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Similarities and Differences between Salt and Shale Tectonics

Many exploration targets are basins where sediments were deposited above a mobile layer of salt (Gulf of Mexico, South Atlantic) or overpressured shale (Niger, Baram, Champion deltas). Because both salt and overpressured shale are weak rocks, their burial under a clastic wedge commonly leads to thin-skinned extension, shortening, and associated diapirism. There are, however, differences in rheological properties between shale and salt. Rock saltÕs low strength is related to lithologic composition; hence, salt remains weak throughout its entire history, and the salt-overburden interface is well defined. Because salt is viscous, its deformation rate depends partly on its viscosity. By contrast, shale is weak only when subjected to fluid overpressure (caused by burial, hydrocarbon generation, or tectonics). Mobile-shale volume can therefore vary through time, and the transition between mobile overpressured shale and stronger shale overburden can be gradual and diffuse. Furthermore, episodic loss of fluids by mud volcanoes can reduce the overpressure, strengthening the shale layer and temporarily halting shale movement. Because shale is a plastic, rather than a viscous rock, its rheology is time independent and its deformation rate is controlled mostly by external parameters (rates of aggradation, progradation, or tectonics). Finally, buoyancy forces differ between shale and salt tectonics. Salt diapirs and mud volcanoes can emerge, rise above the seafloor, and extrude because the density of salt and mud can be lower than that of adjacent, compacted overburden sediments. By contrast, shale diapirs are unlikely to rise above the regional datum and extrude under the effect of buoyancy alone.