

Depositional Significance of Potash Rich Salts in Gotnia Evaporites – Kuwait

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ABSTRACT

Discovery of hydrocarbons from Hith and Gotnia evaporite sequences in North Kuwait accredited the carbonate layers developed in these Late Jurassic formations of Gotnia Basin as potential exploration targets. Gamma ray logs recorded in Hith and Gotnia formations show high radioactive responses at these carbonate layers interbedded with anhydrites. Elemental Capture Spectroscopy (ECS) log recorded recently in few wells has confirmed dearth of clays in these carbonate layers attributing high gamma nature to presence of organic matter. Few intervals displaying anomalously high gamma responses observed within Gotnia Formation in wells located at southwestern and southern parts of Kuwait, however, do not correspond to carbonate layers or to any other organic rich sediments. Instead, they match with salt on mudlog lithology. Detailed analysis revealed that these high gamma layers within predominantly halite a non-radiogenic salt units of Gotnia Formation correspond to potassium rich salt layers and the high gamma values observed is a response to the presence of radioactive potassium (K^{40}) isotope. Presence of potash rich radioactive salts sylvite, carnallite and polyhalite is inferred from log data. Well log correlation shows that these potash rich salts are confined to older 4th and 3rd Gotnia salt units and restricted to southwest and southern parts of Kuwait. 2D seismic line extending from southwest to northeast Kuwait shows thickening of older 4th and 3rd Gotnia units towards southwest. Isopach map showing higher thickness of these units towards southwestern and southern Kuwait also suggest regional depocenter towards this part during deposition of these early Gotnia evaporite sequences. Deposition of potash rich salts in evaporate environments have been recorded to occur during the terminal phases of seawater evaporation. Present study implies that south-southwest Kuwait, a part of regional depocenter within Gotnia Basin witnessed accumulation of brine enriched with potassium during late stages of seawater evaporation depositing potash rich salts. Anhydrite units with carbonate interlayers deposited over 4th and 3rd salts during periods of marine transgression are relatively thick in this part of Kuwait which also support the proposed view. Absence of noticeable potash rich salts in 2nd and 1st Gotnia salt units in study area could be a result of shift in depocenter within restricted Gotnia Basin or due to compositional difference in seawater brine.