

## **Organic geochemical and palynofacies analyses for source rock potential evaluation of the Jurassic Datta Formation, western Salt Range, Pakistan**

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### **Abstract**

The organic geochemical and palynofacies analyses were carried out on twenty rock samples from the Early Jurassic Datta Formation in the western Salt Range, Pakistan. Mostly, type III and type II kerogen with only minor type I kerogen were identified, which are capable of generating both oil and gas. Only few beds showed poor to moderate source rock quality with low Total Organic Carbon and Rock-Eval results. Tmax values vs hydrogen index (HI) plot indicated that some beds in Datta Formation are thermally mature, others are immature and no one is post-mature at current outcrop conditions.

The palynofacies investigation further strengthens the source rock aspect, i.e. kerogen type and thermal maturity. Based on studies of palynological slides, seven palynofacies assemblages were identified; including PDN-1, PDN-2, PDN-3, PDN-4, PDZ-1, PDZ-2 and PDZ-3, which demonstrated that shales and coals are prolific potential source for hydrocarbon generation. Palynofacies analysis also indicated that Datta shales are rich in kerogen macerals, including inertinite, vitrinite, amorphinite (Amorphous Organic Matter) with minor liptinite (i.e. palynomorphs). The organic richness of the Formation is due to good preservation of organic matter under suboxic to anoxic conditions. Spore Colour Index (SCI) and Thermal Alteration Index (TAI) were used to estimate visual thermal maturity of these palynofacies assemblages, which range from 4 to 10 on SCI scale and 2+ to 4 on TAI scale. The SCI and TAI values reflected consistence with geochemical data (i.e. Tmax vs HI plot).

The integration of geochemical and palynofacies findings revealed that there are some beds in the Datta Formation which showed excellent source rock quality, still other showed good to very good source quality and only some beds showed poor to moderate source quality. On average, coals, coal patches, carbonaceous shales, and shales in the Datta Formation showed prolific source rock potential with good to very good source quality and grey shales are poor source rocks.