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Assessment of brittleness and hydrocarbon potential of deep Permian shales in Krishna Godavari Basin, India

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The Permian-aged Kommugudem Formation has been identified as a potential candidate in the prospective Krishna Godavari basin for future shale gas exploration. Brittleness and hydrocarbon potential based on geochemical and mineralogical evidence is characterized from the conventional cores in the study area. According to petrographic, SEM, and XRD analysis, the shale is primarily composed of quartz, clays (kaolinite, chlorite and illite), siderite, muscovite, pyrite, and feldspar. The Mineralogical Brittleness Index (MBI) ranges from 60 to 80 percent, suggesting that the Kommugudem shale is a likely good fracking candidate. Natural microfractures in Formation can increase hydraulic fracturing performance by acting as hydrocarbon migration conduits and hydrocarbon storage sites. The low chemical maturity index of Kommugudem samples indicates an abundance of detrital minerals formed near provenance without significant recycling. Due to the insoluble nature and diagenetic immobility, the Nb and Th enrichment identified in Kommugudem samples further supports a possible detrital source of the quartz. Clay-sized microquartz cement seen in a few samples may bind silt-sized detrital quartz and promote brittleness. The development of recrystallized microquartz cement is also caused by the illitization of smectite clay, as evidenced by XRD data revealing the presence of illite. The mineralogical brittleness index does not take into account the mineral texture or the kind of clay mineral related. As a result, such computations must be used with caution. Kommugudem Formation is composed of Type III kerogen in admixture with Types II-III, with high TOC and Tmax predicting substantial organic matter concentration in the dry and wet gas windows. RockEval and FTIR examinations revealed that two wells had good hydrocarbon generation potential for oil and gas sources, while the other wells had comparatively lesser hydrocarbon potential. Brittleness appears to be substantially reliant on lithological heterogeneity, according to the proposed assessment. The examined area possesses lithological variability, and the Kommugudem shale shows compositional similarities to brittle sections of the Barnett and Marcellus shale plays. According to the integrated characterization, shale has high organic content and is brittle in nature. This comprehension is critical if the shale is to be considered for further investigation.