

Could Gas Hydrate in Fine Grained Sediments be a Precursor for Some Shale Gas Deposits?

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Shale gas is a major energy resource whose potential continues to grow. Understanding the paragenesis of the gas and its concentration in the shale throughout its history of deposition as muddy sediments to its present state is a key to exploration because gas is not equally distributed in the shale host. Presently the gas in the shale is regarded as being produced locally from the local organic matter that constitutes up to 8-10% of the rock. However, there is some question as to whether the indigenous organic matter could actually generate all of the gas locally, for instance for each cubic foot by cubic foot of the shale.

It is possible that the formation of solid, mechanically strong gas hydrate in the muddy shales originally concentrated gas by compressing it into its crystalline lattice. Modern gas hydrate concentrations of 5-10% are common in fine-grained marine sediment sections as thick as 800 feet in continental slopes. Most of gas in the hydrate is regarded as having been generated by both bio- and thermogenic activity in huge subjacent gas production zones. These muddy sediments are estimated to currently hold more gas worldwide than has been identified in conventional and other unconventional gas deposits. If pressure – temperature conditions persisted during lithification of shale gas precursor, at least until packing of the clay minerals effectively reduced permeability to a point that the gas released from hydrate by increasing temperature or decreasing pressure could not migrate easily, then a very large part of this gas would have been trapped in the shales as their further compaction proceeded. An implication for exploration is that high gas concentrations may not be confined to organic-rich shales but may also be found in any shales that once contained substantial gas hydrates, such as lower organic content grey shales and more siliceous shales, which respond well to fracturing.