Shale Gas in the Posidonia Shale, Hils Area, Germany

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Shale gas is a self-sourced resource in which thermogenic or biogenic hydrocarbon gases are contained within a fine-grained, organic-rich, low permeability matrix, occurring in free, adsorbed and dissolved states. While no commercial shale-gas enterprises are currently known outside North America, many parts of Europe contain prime targets for shale gas exploration. One of these is the Posidonia Shale (Lias ε) of northern Germany. The Posidonia Shale in the Hils Syncline is approximately 35m thick and subcrops at relatively shallow depth over a 500 sq km area. It displays a threefold stratigraphic subdivision: lower marlstone, middle calcareous shale with bivalve shells, and upper calcareous shale. It is organic-rich, and lateral variations in its maturity have been related to deep burial or the effects of the Vlotho Massif, a purported deep seated igneous intrusion. We have analysed a total of 300 whole core pieces and core plugs from 6 research boreholes, which completely penetrated the Posidonia Shale of the Hils Syncline, covering the maturity range Rm = 0.48 - 1.45%. The two fundamental components of gas shales, namely the origin/occurrence of in-situ gas and the nature of the rock matrix, have both been studied. Only at the highest studied maturity level (1.45% Ro) does the Posidonia Shale begin to fulfil the empirical organic geochemical criteria which label it as a gas shale candidate. The Posidonia Shale originally contained Type II kerogen of Petroleum Type Organofacies Low Wax P-N-A in all boreholes. Geochemical logging revealed that vertical heterogeneity in richness and quality is significant in single wells, in part related to depositional facies. However, maturity variability between locations is responsible for much larger shifts in TOC, S1 and S2 values. The relative amounts of the different clay mineral groups remain constant with increasing levels of thermal maturity, though porosity and pore size are reduced. Heterogeneities in bitumen, kerogen and mineral abundances at the nanometre scale occur in overmature samples. Gas retention efficiencies for the represented maturation stages were calculated as a function of Transformation Ratio using bulk and compositional mass balance models. Because the Posidonia Shale displays similarities to the Barnett Shale we conclude that it represents a potentially productive gas shale in Germany.