

A Petrography-Based Model of Igneous and Hydrothermal Activity in Diverse Petroleum Basins

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ABSTRACT

Organic and inorganic petrography of rock samples from exploration wells worldwide shows that convective heat flow resulting from movement of hydrothermal fluids is a commercially important but frequently unrecognised process in many petroleum basins (Newman et al. 2013; Edman et al. 2015). Pyrolytic carbon and coked organic matter provide evidence that this hydrothermal activity is often associated with igneous intrusion. The term “hydrothermal” as used here includes the aqueous phase that is exsolved by some magmas at the time of intrusion, fluids that circulate within fault zones and can be heated by intrusion, and pore fluids that are present in sedimentary rocks and can mobilise as a consequence of intrusion. VIRF (vitrinite-inertinite reflectance and fluorescence) analysis sensitively reveals complex maturity profiles in sedimentary basins affected by hydrothermal activity. Additional diagnostic evidence includes hydrothermal mineral assemblages (Newman, R.J. 2017), distinctive microfabrics, and “Microfacies VS”. Microfacies VS is a vesicular melt rock with a distinctive glassy framework that encloses altered phenocrysts and is frequently shattered. This enigmatic lithology is easily missed by petrographers and unlikely to be recognised in well cuttings because it resembles a fine grained sedimentary lithology.