Visual Kerogen Analogues and Palynofacies Applications to Hydrocarbon Exploration in New Zealand

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Abstract

Visual kerogen and palynofacies analyses are useful tools for determining the origin, composition and petroleum generative potential of organic-rich sedimentary rocks and the depositional conditions for a wide range of sedimentary rocks.

Here, we present recent studies that utilize visual kerogen and palynofacies analyses. Firstly, we provide an example of analogues in a northern high-latitude setting. This study aims to test an existing fossil kerogen-based palynofacies model, through applying the model to quantitative palynofacies and environmental data from sediments deposited over the last 1500 years. Secondly, we use the palynofacies model to interpret the depositional environment for the Tartan Formation, a potential Paleocene source rock in the Great South Basin, New Zealand. Thirdly, we introduce preliminary findings from a recent project that aims to develop a standard palynofacies methodology, including laboratory processing and a standardised approach to data collection.

Results from the analogue study show that the distribution of particulate organic matter in environments ranging from near-shore to deep-sea is correlated with distance from the shore. Phytoclasts and amorphous organic matter represent the major components of the total assemblage in coastal and shelfal settings; phytoclasts are rare to absent in the distal, deep-water sediments. In deep-water, palynomorphs consist of a selection of organic material, which could result from transport and/or sorting.

In the Great South Basin, visual kerogen analysis of the Tartan Formation (late Middle to early Late Paleocene) (10% average TOC) indicates that it was deposited in a marginally marine environment with a strong influx of terrestrial plant detritus. Analysis of the underlying and overlying units indicates that they were deposited under more distal conditions. The changes observed are best explained by a base-level fall and short-lived regression, including deposition of the Tartan Formation, followed by latest Paleocene–Eocene transgression.

However, recent comparisons of palynofacies results from several GNS Science palynologists has shown that occasionally different researchers can produce different results from the same sample, mainly due to an absence of a standardised approach, a reference set of morphologic types for categories of particulate organic matter (analogous to taxonomic type specimens), and criteria for laboratory extraction techniques. A detailed study is presently being carried out in order to resolve this matter. As a result, processing costs for new palynofacies samples may be significantly reduced if we are able to isolate the aspects of the assemblage unaffected by variation in laboratory extraction technique. Moreover, this will allow data to be extracted from the large existing resource of >25,000 palynological preparations that already exist in the GNS Science collections.