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Mineralogy and geochemistry of Palaeozoic black shales from Peninsular Malaysia: Implications for their origin and maturation

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Abstract

Palaeozoic black shale-bearing formations comprise 25% of the sedimentary cover in Peninsular Malaysia. However, nothing has been published regarding their geology, composition and maturation. Representative samples from different ages and localities of the black shales were subjected to detailed mineralogical and geochemical investigations during this study to determine their origin. These investigations also provide an opportunity to trace the changes in depositional environments and paleoclimate during the Palaeozoic as well as the nature of unknown and hidden basement rocks in Malaysia.

This paper reports nineteen Palaeozoic formations in Malaysia that contain black shales that are classified into seven categories based on their age. These are the Cambrian-Ordovician, Ordovician-Devonian, Silurian-Devonian, Devonian, Carboniferous, Carboniferous-Permian and Permian black shales. Although illite was identified in all black shales, other clay minerals including kaolinite and smectite-illite mixed layers show significant variations among the studied samples. The $\text{Al}_2\text{O}_3/\text{TiO}_2$ ratios (13-33), SiO_2 contents of probable magmatic source rocks (54-69 wt. %) and Zr- TiO_2 bivariate diagram suggest a mixture of felsic and intermediate source rocks for the studied black shales. This indicates that the hidden basement rocks in Malaysia are dominated by felsic igneous rocks. Variations in clay minerals, SiO_2 and $\text{Al}_2\text{O}_3/\text{TiO}_2$ ratios and upper continental crust (UCC)-

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