
Black Shale—Its Deposition and Diagenesis¹

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Abstract: Black shale is a dark-colored mudrock containing organic matter that may have generated hydrocarbons in the subsurface or that may yield hydrocarbons by pyrolysis. Many black shale units are enriched in metals severalfold above expected amounts in ordinary shale. Some black shale units have served as host rocks for syngenetic metal deposits.

Black shales have formed throughout the Earth's history and in all parts of the world. This suggests that geologic processes and not geologic settings are the controlling factors in the accumulation of black shale. Geologic processes are those of deposition by which the raw materials of black shale are accumulated and those of diagenesis in response to increasing depth of burial.

Depositional processes involve a range of relationships among such factors as organic productivity, clastic sedimentation rate, and the intensity of oxidation by which organic matter is destroyed. If enough organic material is present to exhaust the oxygen in the environment, black shale results.

Diagenetic processes involve chemical reactions controlled by the nature of the components and by the pressure and temperature regimens that continuing burial imposes. For a thickness of a few meters beneath the surface, sulfate is reduced and sulfide minerals may be deposited. Fermentation reactions in the next several hundred meters result in biogenic methane, followed successively at greater depths by decarboxylation reactions and thermal maturation that form additional hydrocarbons. Suites of newly formed minerals are characteristic for each of the zones of diagenesis.

Key Words: Black shale • Deposition • Diagenesis • Organic matter • Syngenetic ores

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