

ORGANIC-RICH, RADIOACTIVE MARINE SHALE: A CASE STUDY OF A SHALLOW-WATER CONDENSED SECTION, CRETACEOUS SHAFTESBURY FORMATION, ALBERTA, CANADA¹

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ABSTRACT

Organic-rich radioactive shales are a common regional feature resting on Cretaceous transgressive surfaces in western Canada. The basal shale in the Shaftesbury Formation (Late Albian) from the Peace River area of northern Alberta is characterized by high gamma-ray, high resistivity, and low neutron wireline log signatures. Three facies, in ascending order, are present within the basal Shaftesbury Formation: 1) a brackish-water estuarine shale; 2) a restricted, marginal marine shale which is radioactive; and 3) an open-marine, normal salinity shale. The radioactive shale contains an abundance of large, lenticular algal cysts (cf. *Lancettopsis lanceolata* Mädlér 1963) which are rare in overlying and underlying shale. The algal cysts and high organic content may be the locus of the radioactivity. The total organic carbon content (~6%) and sulphur content (~3.4%) of the radioactive shale also are higher than the shale above and below, with a different mineralogy as well. The radioactive portion of the basal Shaftesbury shale has the characteristics of a condensed section; it is directly above a ravinement surface and transgressive-lag deposit which, in turn, locally overlie estuarine sediments deposited within an incised valley. Other characteristics include evidence of low oxygen values, low concentrations of benthonic foraminifera, and evidence of a slow sedimentation rate. Palynological, micropaleontological, and geochemical results indicate that the radioactive shale was deposited in restricted, marginal marine conditions and that overlying shale shows a progressive deepening to nearshore, open-marine conditions. This radioactive shale does not represent the deepest water sediments of the transgression but is a condensed section deposited in relatively shallow water.

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