Interplay of tectonics, volcanism and diagenetic processes in Lower Cretaceous sediments of the Chaswood Formation and Scotian Basin

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The Chaswood Formation is a fluvial succession deposited over a long period of time in the Early Cretaceous, during deposition of the Missisauga and Logan Canyon formations offshore. Deposition was synchronous with strike-slip faulting, basin formation, and uplift of horsts that shed local detritus. The formation is cut by a major regional unconformity corresponding to the top-Missisauga unconformity in Orpheus graben. Chaswood Formation tectonics form a linked system with the Laurentian sub-basin and Jeanne d'Arc basin.

Lignites from the Chaswood Formation have several features indicating the presence of volcanic ash: unusual abundance of high-field-strength elements such as Nb, Ta and Hf; the presence of augite in EMP and XRD analyses; the rare presence of euhedral quartz; and aluminophosphate-sulphate minerals that appear to pseudomorph volcanic ash. Some wood or charcoal fragments appear mineralized and diagenetic talc is present. Much of the terrigenous component of the lignites consists of background detrital sediments (characterized by detrital illite) and most of any ash component has been altered to kaolinite. Bulk composition of ash is inferred to range from basaltic to rhyolitic. The closest sources of ash are the early Albian volcanic rocks within the lower Cree Member of the Orpheus graben, correlated with the middle member of the Chaswood Formation, and Berriasian to Barremian volcanic rocks on the SW Grand Banks and Fogo Seamounts, correlated with the lower member.

Early diagenesis by meteoric water at unconformities resulted in widespread kaolinitization of the Chaswood Formation and the upper member of the Missisauga Formation in Orpheus graben. During burial diagenesis of the Chaswood Formation, sandstones were cemented by pore-filling illite, barite, and quartz. Strong cementation in the lower member is related to high Albian geothermal gradients. Late diagenetic phases controled by CO_2 and H_2S in the Scotian basin during

hydrocarbon charge are lacking. The Chaswood Formation was in diagenetic continuity with the Scotian basin until Oligocene uplift, which led to erosion of at least 700 m of overlying Dawson Canyon and Banquereau formations that are recognised along strike in Orpheus graben. The Chaswood Formation is now preserved in only a few basins that were not uplifted in the Oligocene tectonic event.

Ilmenite was a major detrital mineral in the Chaswood Formation and its breakdown to silt-sized pseudorutile provided a source of labile Fe for early diagenesis in the Scotian basin. Volcanic ash by direct fallout and fluvial reworking was another important source of labile Fe. These sources promoted the authigenic or early diagenetic formation of berthierine and chamosite in the Missisauga and Logan Canyon formations. These minerals are important in the formation of chlorite rims that preserve porosity in reservoir rocks of the Missisauga Formation.