

Did Sulphur in Sydney Coal Come From the Windsor Group Evaporites?

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High sulphur contents in coals are normally explained by the proximity of the original peat to marine waters during deposition, as the sulphate ions in seawater provide an abundant source of sulphur. However coals of the Pennsylvanian Morien Group, which are rich in sulphur, are associated with a freshwater biota and alluvial sedimentary features, and no marine beds are known in the succession. Several workers have suggested that the sulphur was derived from dissolution of sulphate evaporites in the underlying Mississippian Windsor Group, rather than from Pennsylvanian seawater.

We set out to test this hypothesis

using a geochemical model derived from studies of sulphur isotopes in modern peat swamps. During the anaerobic decomposition of plant material, the H₂S generated from groundwater sulphate is fixed as metal sulphides which are enriched in the lighter ³²S isotope by about 15 ‰. Sulphides formed chemically at higher temperature during burial will be much less fractionated. As Windsor sulphates on mainland Nova Scotia have δ³⁴S values of about +14 ‰, coal pyrite derived from a Windsor source should range from +14 to about -1 ‰, depending on the proportion of biologically and chemically precipitated pyrite in the coal.

Eight evaporite samples from the upper Windsor Group in the Sydney Basin gave $\delta^{34}\text{S}$ values of about +15 ‰. Eleven pyrite samples from four Morien coal seams ranged from +14.6 ‰ to -5 ‰. The pyrite values thus follow the pattern predicted for derivation from Windsor sulphates. The Gardiner Seam, the stratigraphically lowest studied, contains the most fractionated sulphur, suggesting that much of the sulphur came into the swamps from the Morien rivers and was fixed shortly after deposition. The Harbour, Hub and Point Aconi Seams, higher in the section, probably obtained much of their

sulphur from groundwaters during burial.

Due to the similarity of $\delta^{34}\text{S}$ values for Mississippian and Pennsylvanian seawaters, the test does not preclude a marine source of sulphate during Morien times. The results, however, are consistent with a Windsor sulphate source. Our study has application, with further work, to the tracing of sulphur emissions from industrial plants.

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