PROCEEDINGS OF THE YORKSHIRE GEOLOGICAL SIOCIETY, VOL53, PART 1, PP.43-72, 2000

Stratigraphic evolution of provenance characteristics in Westphalian sandstones of the Yorkshire Coalfield

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SUMMARY: A combined study of heavy minerals and palaeocurrents shows that three main fluvial systems transported sediment to the Pennine Basin during Namurian and Westphalian times. The first, which brought a garnet-rich monazitic heavy mineral suite from the north, peaked in the Namurian and diminished through the Langsettian. The second flowed from the west, bringing heavy mineral suites with low garnet, low monazite and variable amounts of chrome spinel. It started in the late Namurian, replaced the first system in the Langsettian, and dominated thereafter until it was itself replaced in the late Duckmantian by the third system. This brought a garnetiferous heavy mineral suite with both monazite and chrome spinel from the east or southeast and continued to the top of the preserved sequence, in the late Bolsovian. The first sourceland lay to the north, perhaps between Laurentia and Baltica, and included high grade metasediments or charnockites and granites. The second sourceland lay to the west and included mature, pre-existing clastic sediments of Devonian and possibly Lower Palaeozoic age. Ultramafic rocks such as ophiolites, possibly associated with Lower Palaeozoic ocean closure, were periodically exposed there. The third sourceland lay to the south, probably within the uplifting Variscan orogenic belt. It included low to moderate grade metasediments, high-grade gneisses, granites and ultramafic rocks.