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The palaeomagnetism of glauconitic sediments

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The palaeoenvironmental significance of glaucony has long been appreciated, but accurately dating the events recorded by glauconitic horizons often requires an understanding of its palaeomagnetic behaviour. We present the results of the first investigation into the relationship between glaucony and remanence acquisition.

Pure glauconitic minerals are paramagnetic, but glaucony grains are large and slow-forming, with complex and various morphologies. It is thus possible that small magnetic grains within glaucony particles may carry a significant fraction of the remanence in weakly magnetized sediments. For palaeomagnetic work, it is important to understand the rock magnetism of glaucony, since it forms diagenetically at the sea floor over periods which can exceed 100 kyr. This means that any remanence carried by glauconitic grains may represent the geomagnetic field at a time significantly later than the time of deposition, as is known to be possible for greigite.

We investigated this problem using samples of weakly magnetic Palaeocene glauconitic siltstone from Fairfield Quarry in southern New Zealand. We disaggregated the rock and separated it magnetically into glauconitic and non-glauconitic fractions. We analysed whole-rock samples and separates using stepwise IRM acquisition, temperature dependence of magnetic susceptibility, and stepwise thermal demagnetization of a triaxial IRM. The results show that the remanent magnetization is carried by sub-micron magnetite in the non-glauconitic fraction of the sediment, and that the glaucony grains themselves make no significant contribution to the remanent magnetization. The identification of magnetite as the remanence carrier in a reducing environment gives a high confidence that the remanence is of depositional origin.

Since the glaucony was found not to carry a remanence, its most significant effect on palaeomagnetic studies is to weaken the overall magnetic moment. The main difficulty of palaeomagnetic work on glauconitic sediments is thus accurate measurement of the weakened magnetic signal rather than determining the time of remanence acquisition. The other complication introduced by the glauconitic content is in the application of rock magnetic parameters and biplots: the glaucony susceptibility dominates that of the remanence carriers, producing inaccurate estimates for magnetic mineralogy and grain size.