Reidar Løvlie and Plate Tectonic consequences of sedimentary inclination shallowing

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Reidar Løvlie was my mentor and supervisor in the early 1980s and he thought me all about laboratory experiments and palaeomagnetic methods, but also various aspects of science philosophy. My first fieldworks were together with him and I enjoyed memorable trips to the Bear Island, Spitsbergen and Scotland. Acquisition of magnetism in sediments was always a favourite topic of Reidar and in the early 1980s he was particularly interested in sedimentary inclination shallowing. From one of our fieldtrips to Spitsbergen we sampled unconsolidated flood-plain deposits of hematite-bearing Devonian red sand/siltstone from Dicksonfjorden. These were used for redeposition experiments in a coil system that could simulate different latitudes (field inclinations) and in 1994 we published a paper entitled"Magnetic remanence and fabric properties of laboratory-deposited hematite-bearing red sandstone" that demonstrated the tangent relationship between inclinations of detrital remanent magnetization and the ambient magnetic field. Inclination (I) error in sediments is latitude dependent, antisymmetric and the bias closely mimics errors produced by octupole fields of the same sign as the dipole field. Inclination shallowing is commonly predicted from tan (Observed Inclination) = f * tan (Field Inclination) where f is the degree of inclination error. In our study we calculated a f value of 0.4 and this laboratory value (and many others) is significant lower than those estimated from the E/I or the magnetic fabric methods developed in the past decade (f typically around 0.6). There is now little doubt that inclination shallowing in detrital sediments is a serious problem that affects plate reconstructions and apparent polar wander paths. As an example, a f value of 0.6 amounts to a latitude error of 1600 km at around 50 degrees N or S (comparable to the effects of octupole contributions as high as 22%) and this have led to erroneous Pangea reconstructions.