Evidence for detrital remanent magnetization carried by hematite in Devonian red beds from Spitsbergen; palaeomagnetic implications

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Summary. Palaeomagnetic investigation of the Devonian red bed succession of Central Spitsbergen, the Wood Bay Formation, uncovered stable magnetic directions associated with blocking temperatures above 600°C. Rock magnetic properties are characterized by features commonly found in hematite-bearing red sandstones. The scattered directional distribution of stable magnetic components show large, non-systematic spatial variations hardly compatible with magnetic overprinting processes. Petrographic observations (Friend), suggest a detrital origin of the hematite granules present, probably derived from a lateritic source area. A depositional origin of magnetizations carried by hematite is also inferred from almost coinciding azimuthal distributions of remanent directions and maximum axis of susceptibility ellipsoids. Effects of the depositional environment upon the acquisition of DRM carried by hematite is discussed. Subjective pattern recognition of directional distributions from sampling areas on both sides of the Dicksonjorden, enables a tentative stratigraphic correlation reflecting the presence of pre-Middle Carboniferous faulting downthrowing to the east. A clockwise post-Devonian rotation of the Central Spitsbergen (uncertain magnitude) is inferred from an estimate of the Devonian palaeomagnetic meridian.

Introduction

The geology of the Svalbard archipelago reflects a number of geodynamic episodes related to the evolution of the North Atlantic region. Structural features reflect the superposition of four main episodes of deformation, of which the Caledonian orogeny was the most intense. The succeeding three tectonic events were associated with faulting and strike-slip movements rather than metamorphism. The geodynamic implications of these N–S striking fault patterns range from a pure fixistic interpretation (Krasil'cikov 1979) to a mobilistic model.
postulating differential movements of three separate blocks now constituting the Svalbard archipelago (Harland & Wright 1979). Palaeomagnetic directions residing in the Devonian Old Red Sandstone sequence, confined to the central graben of Spitsbergen, may elucidate the late post-Devonian tectonic history of the archipelago during which major strike-slip movements have been postulated (Harland & Wright 1979).

Previous palaeomagnetic investigations of the Devonian red bed formation on Spitsbergen have not been successful in retrieving acceptable distributions of remanent directions (Storetvedt 1972; Jelenska, Kruczyk & Kadzialko-Hofmokl 1979). This has been attributed to geomagnetic polarity changes during acquisition of chemical remanent magnetizations (CRM) associated with rather complex diagenetic oxidation/reduction processes of the magnetic minerals (Storetvedt 1972).

The origin of stable remanent directions in hematite-bearing red beds is still a matter of dispute. Hematite may occur both as relatively large, polycrystalline grains (specularite) and as a fine-grained pigment coating detrital grains. While specularite may be of both detrital and/or post-depositional origin (martite), pigment is exclusively attributed to precipitation of hematite associated with diagenetic processes in oxidizing environments. In order to discriminate between specularite and pigment as carriers of natural remanent magnetization acid leaching experiments have been applied. This approach rests on the assumption that the latest precipitated hematite (pigment) forms a coating on mineral grains and is selectively dissolved first by the action of acids. Experiments have demonstrated the presence of sometimes very complex systems of remanence directions (Roy & Park 1974) attributed to the acquisition of CRM in different palaeomagnetic field directions. Redeposition experiments of different fractions of crushed red beds has established characteristic thermal demagnetization features of depositional remanent magnetizations (DRM) carried by pigment and specularite (Collinson 1974).

A post-depositional origin of magnetization carried by pigment and/or specularite implies an unknown time of magnetization. Depending on the rate of hematite formation, red beds may be postulated to record substantial time-averages of geomagnetic field variations. Spectral analysis of reversal features within the Triassic Moenkopi formation, however, has been interpreted to reflect contemporaneous acquisition of stable remanent directions (Baag & Helsley 1974). Similar conclusions, regarding the time of magnetization, has been inferred from results of fold and conglomerate tests within the same formation (Purucker, Elston & Shoemaker 1980). Opposing views have been proposed from petrographic studies of the Moenkopi Formation which reports on five or possibly six different generations of hematite all suggested to be potential carriers of remanent magnetizations (Walker et al. 1981). Objections to contemporaneous acquisition of remanent magnetization in red beds is mainly based on the observation that Holocene hematite (pigment) carrying deposits are rare, as opposed to deposits showing different stages of red-staining interpreted to represent red-beds in the making (Walker 1974; Larson & Walker 1975).

Redeposition experiments of naturally disintegrated hematite-bearing sediments have recently (Tauxe & Kent 1984; Løvlie & Torsvik 1984) established that DRM carried by detrital hematite record the ambient magnetic field with errors in inclination described by the classical disc/sphere model (King 1955). Post-depositional rotation of hematite grains has been shown to result in remanent magnetizations parallel to the ambient magnetic field (Tauxe & Kent 1984). However, other experimental results suggest that remanence properties in hematite-bearing sand-silt sediments may depend on the experimental conditions (Løvlie & Torsvik 1984). Since sand-sized sediments are deposited in high energy environments a DRM is likely to be affected by randomizing processes acting during deposition.
Magnetic hematite in Devonian red beds

Geology and sampling

The Late Silurian to Devonian sandstone succession which is confined within an area bounded by N–S striking faults in North Central Spitsbergen (Fig. 1) accumulated after major Caledonian folding and metamorphism and was subsequently exposed to the Upper Devonian (Svalbardian) phase of folding and faulting (Friend & Moody-Stuart 1972). The thickness of the various formations covers some 8 km, of which the investigated Wood Bay Formation amounts to some 3 km.

The environment of deposition include torrential alluvial fans, river flood-plains, brackish lagoons and inland lakes. No indications of marine conditions have been observed. Three river systems flowing towards a northern area of clay flats have been distinguished (Friend 1961).

Thin section analysis of the Wood Bay Formation sandstone has revealed the presence of red pellicles, composed of hematite granules (< 1 μm), which surround detrital grains. The red pellicles indicate a detrital origin of hematite derived from an area of lateritic weathering (Friend 1961). Post-depositional continuation of the oxidizing conditions has probably been low or moderate since in the coarser, grey-coloured sediment red pellicles are virtually absent (Friend 1961). This suggest that in high-energy environments, necessary for the accumulation of coarser beds, fine-grained hematite flakes were transported out of the area of deposition.

![Figure 1](https://academic.oup.com/gji/article-abstract/79/2/573/628235)

**Figure 1.** Maps of Spitsbergen and the Dicksonfjorden sampling area. Regional bedding of the Wood Bay Formation red beds (136/8) and sampling localities (numbers) are shown.
Palaeomagnetic samples of the Wood Bay Formation were collected in Dicksonfjorden, where the formation tilts slightly towards the SE (Fig. 1). The sampling localities are situated at shore level and covers the top 800 m of the red bed succession unconformably underlying Middle Carboniferous Limestones. Continuous stratigraphic sampling was prevented by areas of extensive surface weathering and scree coverage. One locality (site 16) consists of a coarse, grey-coloured rock, while the other localities are dominated by silt-sand deposits showing different hues of red to brown. Each locality is represented by 5–10 drill cores (19 mm in diameter). Sun compass orientations were only obtained occasionally due to weather conditions, but the available observations defined magnetic deviations close to zero which is in agreement with observatory measurements in Ny Ålesund some 60 km to the NE.

**Rock magnetic properties**

IRM-acquisition curves to 0.8 T of samples from all stratigraphic levels revealed identical features, as shown in Fig. 2(a). High coercivity minerals, which do not reach saturation in the maximum field available, associated with back-fields above 0.3 T, is indicative of fine-grained hematite (Dunlop 1972).

With the exception of samples from site 16 (coarse, grey-coloured rock), thermomagnetic curves exhibit identical features regardless of stratigraphy. A single, reversible Curie

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**Figure 2.** Plots of characteristic rock magnetic properties. (a) IRM-H acquisition and back-field curves. (b) and (c) thermomagnetic curves for red silt-sand samples and grey sand samples (arbitrary units). M and H, Curie points of magnetite and hematite respectively. (d) and (e) variation of reversible bulk susceptibility with temperature, (f) rotational hysteres curve, arbitrary units (\(W_r\)).
temperature around 670°C, indicative of almost pure hematite, is associated with a substantial paramagnetic contribution (Fig. 2b). Thermomagnetic curves obtained from site 16, show the characteristic increase in saturation magnetization upon heating to temperatures above 400°C indicative of magnetite production through the transformation of titanomaghemite. The magnetite Curie point (M, Fig. 2c) is not present upon cooling from 700°C, probably due to complete oxidation to hematite. The hematite Curie point (H, Fig. 2c) reflect the contribution from both the oxidation product of magnetite and the initial content of hematite.

Previous published thermomagnetic curves from the Wood Bay Formation (Storetvedt 1972), reflect the presence of substantial amounts of titanomaghemite. In the present material titanomaghemite was encountered only in coarse grey-coloured rocks, suggesting that previous thermomagnetic results of the Wood Bay Formation were obtained from coarser sequences than the present study. By magnetic extraction procedures of some recent flood-plain deposits, composed of disintegrated red sandstones from Dicksonfjorden, a small amount (<0.3 per cent) of titanomaghemite was obtained (Løvlie & Torsvik 1984). The presence of titanomaghemite within red bed deposits indicates that post-depositional oxidation of detrital grains has been minor.

Determination of the reversible bulk susceptibility in conjunction with progressive thermal demagnetization reveal a substantial increase in susceptibility above 500°C (Fig. 2d, e). This phenomenon is often encountered in hematite-bearing sediments and has been related to the production of magnetite by transformation of non-magnetic minerals (Stephenson 1967; Dunlop 1972). This conclusion has been questioned (Torsvik & Løvlie 1983) on the grounds that the amount of secondary magnetite relative to the primary content of hematite should enable a direct detection by thermomagnetic analysis, which remain to be established. In the present context it is emphasized that the Wood Bay Formation sandstone exhibits rock magnetic features characteristic of hematite-bearing sandstones in general.

Rotational hysteresis, determined on a few samples, also exhibit features indicative of hematite (Fig. 2f).

Although the present material is suggested to be dominated by hematite, titanomaghemite phases may contribute to remanence properties associated with blocking temperatures below 580°C.

Demagnetization experiments

Measurements of the remanent magnetization have been performed using three different magnetometers: a Digico balanced flux-gate spinner, a single axis SQUID and a JR-4 spinner magnetometer. The latter is situated at the Polish Academy of Sciences, Warsaw, while the former instruments are located at the University of Bergen. Anisotropy of magnetic susceptibility (AMS) was determined on an induction bridge (Kappabridge, KLY-1).

NRM intensities range between 1 and 10 mAm⁻¹ and bulk susceptibilities between 12 and 60 × 10⁻⁵. NRM directions within and between sites as well as from cylinders from identical drill-cores showed a high degree of non-systematic scatter.

Progressive alternating field demagnetization to 80 mT in a two-axis tumbler system, was not successful in reducing NRM intensities by more than 55 per cent. This partial demagnetization was associated by only minor directional changes, cf. Fig. 3.

Chemical demagnetization by acid treatment turned out to be unsuccessful due to complete disintegration of the samples after only short exposures to dilute hydrochloric acid.
The samples were thus subjected to thermal demagnetization treatment in two different furnaces, one Schonstedt Model TSD-1 Thermal Demagnetizer (Bergen) and one built by the Polish Academy of Sciences (Warsaw). In both furnaces, multiple permalloy shields are utilized to achieve close to field-free cooling environments (<10 nT).

**Directional properties**

During progressive thermal demagnetization to 700°C non-systematic directional changes were encountered in less than half of the investigated samples. Characteristic behaviour during thermal demagnetization is shown in Fig. 4. The stereographic and vector plots (a), (b) and (d) show that an almost vertical component is removed below 625°C associated with slightly decreasing intensities. The final two steps, prior to reaching intensities comparable to the noise level of the instruments, define a significantly shallower component. Fig. 4(c) reveals a completely different behaviour, in that a continuous and gradual decrease in intensity is associated by a shallow-dipping component below 600°C.

Fig. 5 demonstrates directional changes of two samples from site 3 determined in Warsaw (IS23-A2) and Bergern (IS22-B). Both samples define stable, coinciding directions after demagnetization to 600 and 200°C respectively. Pronounced different directional behaviour during demagnetization is attributed to small-scale spatial variations in the properties of remanence carrying minerals.

With few exceptions acceptable stable directions are associated with blocking temperatures above 575°C (Fig. 6). More or less systematic great-circle trends may precede terminal directions, indicate of at least a two component system in which one component is probably of viscous or chemical origin (IS4A, IS7B, Fig. 6). Demagnetization curves show a variety of patterns ranging from almost square-shaped (IS18A2, Fig. 6) to more linear decay curves (IS110A). The latter sample carries a stable, steeply dipping direction coinciding fairly well.
Figure 4. Stereographic and vector presentation of thermal demagnetization results. Unit on vector axis, 1 mA m$^{-1}$.

Figure 5. Thermal demagnetization results of two samples from site 3. Left: normalized intensity decay curves. Stereographic plot shows palaeomagnetic directions (open/filled circles) and removed vector components (triangles). Demagnetization temperatures in °C. Vector component intervals (°C) indicated by horizontal arrows.
with the present geomagnetic field direction. This component is associated with blocking temperatures below 580°C, indicating a present-day CRM probably residing in titanomaghemite. Above 580°C the directional trend reflect the presence of a shallow dipping component.

A total of 130 samples were subjected to step-wise thermal demagnetization. Seventy-nine samples were accepted to carry stable or metastable directions, shown in Fig. 7. Results obtained in the two laboratories appear to agree fairly well (Fig. 5), but the directional scatter evidently does not justify a more analytical comparison to be carried out. Although the distribution of stable directions is rather scattered, a pronounced grouping is evident in the south-west quadrant. Standard great circle and vector subtraction analysis were unsuccessful in uncovering unambiguous systematic distributions of removed components, and no objective way of filtering has been attempted. The non-systematic directional distributions within sites and between cylinders from identical drill-cores suggest either that the stable directions represent systems of two or more superimposed components residing in minerals with overlapping blocking temperature spectra, or that stable directions do not necessarily reflect directions of the geomagnetic field. The latter alternative implies the

Figure 6. Characteristic thermal demagnetization results.
Figure 7. Distribution of accepted stable directions from the Wood Bay Formation, Dicksonfjorden.

Figure 8. Schematic cross-section of primary slump structure. Sample positions indicated by filled circles. Directional variations and intensity decay curves shown for drill cores, 24, 26, 38T (top) and 38B (bottom). Accepted, metastable directions indicated by asterisks. Noise level of instrument indicated by the horizontal broken line.
action of randomizing processes in conjunction with the acquisition of stable remanent magnetizations. The origin of magnetization thus appear to be crucial in order to understand the obtained results.

During a second field season to the Dicksonfjorden area, a small, primary slump structure was located and sampled in detail. Fig. 8 shows a cross-section of this sedimentary feature with the positions of the 26 collected oriented samples. Results of progressive thermal demagnetization of two cylinders from the same drill-core, 38T (top) and 38B (bottom) (Fig. 8), illustrate the complexity of magnetization. Demagnetization curves are similar to 450°C, but while the bottom cylinder define a metastable direction below 580°C, the top cylinder of the same core carries a metastable component above 585°C. The large discrepancy between directions residing in cylinders from the same core is suggested to reflect the scale of spatial inhomogeneity of the remanent magnetization. The highly scattered distribution of metastable directions are shown in Fig. 9.

It has been demonstrated that even after deformation (folding) of wet, cohesive clay-silt sediments the direction of the primary magnetization may be obtained by correcting for local folding (Verosub 1975). Applying a correction for the small-scale ‘bedding’ for each sample, results in a distribution of the stable directions shown in Fig. 9. It is apparent that this bedding test is negative with respect to elucidating the acquisition time of magnetization relative to the time of slumping.

Anisotropy of magnetic susceptibility

Determination of the AMS-ellipsoid directions and parameters of 80 samples from all stratigraphic levels resulted in distributions of minimum and maximum susceptibility axes shown in Fig. 10. The almost vertical distribution of the minimum axis defines a bedding plane almost coinciding with the observed sedimentary regional bedding plane. Almost flat-lying maximum axis define azimuthal distributions striking NE–SW. All AMS-ellipsoids are oblate ($E > 1$) with anisotropy factors ranging between 6 and 10 per cent. Foliation parameters have comparable magnitudes while lineations are significantly lower ($<1–2$ per cent).

Magnetic fabric properties of magnetite-bearing sediments deposited under different conditions are fairly well known (Hamilton & Rees 1970), as opposed to hematite-bearing
Magnetic hematite in Devonian red beds

Figure 10. Directional distributions of maximum \( k_{\text{max}} \) and minimum \( k_{\text{min}} \) AMS axis. Flow direction of palaeocurrent (Friend & Moody 1972) shown by the double arrow. Mean azimuth of maximum susceptibility axis shown by the arrow. Projection of the measured mean regional bedding plane is on the lower hemisphere.

Deposits. The origin of AMS in magnetite and hematite is fundamentally different in that the former is related to a geometric shape effect while the latter is due to magnetocrystalline effects. Hematite has a ferrimagnetic moment due to imperfect antiparallelism between crystallographic sub-lattices. This spin-canting effect gives rise to a weak spontaneous magnetization confined to lie in the basal-plane. This ferrimagnetic susceptibility is superimposed on an isotropic antiferromagnetic susceptibility which amounts to only 1/5 of the former for single domain grains (Stacey 1963). Hematite in effect has a uniaxial susceptibility with the maximum susceptibility restricted to lie in the basal plane.

The mean palaeocurrent direction for Dicksonfjorden (Friend & Moody-Stuart 1972), shown in Fig. 10, is almost along the strike of the regional bedding, and almost perpendicular to the mean direction of maximum susceptibility. The orientation of long axis of grains deposited in flowing water may be parallel or perpendicular to the water flow depending on the relative grain size distribution between the sediment surface and deposited grains (Rusnak 1957). AMS of magnetite is related to the geometric shape of individual grains and may reflect the statistical orientation of long axis. Similar considerations are not applicable for rocks carrying detrital hematite grains since the AMS of the latter is crystallographically controlled.

Discussion

Origin of Magnetization

Distributions of very scattered palaeomagnetic directions in red sandstones may be attributed to unresolved multicomponent systems, disturbed ambient field conditions during remanence acquisition (Collinson 1980) or to processes affecting the ability of a
sedimentary rock to acquire and maintain a record of the ambient field. Since a disturbed geomagnetic field configuration is likely to be rather short-lived, it may be almost impossible to verify such interpretations.

Different diagenetic generations of hematite have been interpreted to favour a chemical origin of magnetic components associated with blocking temperatures in the 600–650°C range, and multicomponent systems have been proposed in order to explain complex directional behaviour in hematite-bearing rocks. Similar considerations, however, can also be applied to rocks containing detrital grains of hematite. Depending on grain-size distributions, hydrodynamic conditions during deposition may affect the alignment of different populations of hematite grains to different extents. Situations may arise in which the orientation of one fraction of grains is dominated by the magnetic field, while other grains fractions are predominantly affected by ‘randomizing’ forces acting during deposition (currents, turbulence). Since blocking temperatures are grain-size dependent, directional trends during thermal demagnetization may incorrectly be interpreted to reflect the effect of palaeomagnetic overprinting.

A DRM origin of magnetic components with blocking temperatures comparable to that of hematite, presumes that the composition of the source material can be determined. In the Wood Bay Formation, granules of hematite, usually attributed to post-depositional precipitation, appear to have been derived from a lateritic source area, implying a predominantly detrital origin of hematite.

DRM carried by hematite is characterized by systematic errors in inclination (Tauxe & Kent 1984; Løvlie & Torsvik 1984), which is likely to be grain-size dependent. Post-depositional realignment of hematite grains has been experimentally demonstrated (Tauxe & Kent 1984), but is suggested to be less effective than alignment during deposition due to the weak magnetic torque acting on hematite grains. In low-energy environments (still-water), DRM carried by hematite record the true azimuth of the ambient magnetic field, so even with errors in inclination a palaeomagnetic meridian may be determined.

The Dicksonfjorden stable directions appear to be distributed symmetrically along a NE–SW axis (Fig. 7). The large azimuthal scatter is attributed to remanent components residing in detrital grains partly disturbed by randomizing forces acting during deposition in the high energy environments (torrents, floods, rivers). This interpretation, in conjunction with results obtained from the primary slump feature (Fig. 9) implying negligible CRM acquisition or post-depositional realignment of detrital hematite grains, suggests a detrital origin of magnetization.

Redeposition experiments have demonstrated coinciding azimuths between directions of maximum susceptibility and DRM in hematite-bearing deposits (Løvlie & Torsvik 1984), probably related to the common origin of susceptibility and spontaneous magnetization in hematite grains. The mean azimuths of maximum susceptibility and stable directions (Figs 10 and 7) are seen to agree fairly well. It is concluded that the stable directions encountered in the investigated Wood Bay Formation are basically carried by detrital hematite.

Almost coinciding directions of stable magnetizations and the maximum axis of susceptibility have been reported previously from the Permian Dome de Barrot red beds (Van den Ende 1977), which was concluded to carry a depositional magnetization recording a time sequence of the contemporaneous geomagnetic secular variation.

**STRATIGRAPHIC CORRELATION**

The palaeomagnetic sampling localities are situated on both sides of the Dicksonfjorden. The base of the sequence in this area is not exposed, and the stratigraphic positions of the
five sampling areas have been calculated relative to the Carboniferous Limestone sequence overlying the Devonian red bed succession. Fig. 11 shows the distributions of stable directions obtained from the five sampling areas. The large directional scatter within each group is apparent. Calculations of mean directions are not justified due to lack of objective criteria for filtering or sub-grouping. However, by subjective pattern recognition, the two stratigraphic lowermost groups on either side of the Dicksonfjorden appear to show almost identical directional patterns. The correlation between these groups (as suggested in Fig. 11) is admittedly highly speculative, but considering that contemporaneous deposition under still-water conditions across large lateral distances will result in sedimentary horizons carrying coinciding DRM directions reflecting the action of the ambient magnetic field, disturbances of DRM caused by similar depositional environments may turn out to generate corresponding directional patterns.

The correlation shown in Fig. 11 implies that the Dicksonfjorden may represent a topographic feature associated with a normal fault down-throwing to the east. To the south,

Figure 11. Distributions of stable directions from five sampling areas on both sides of the Dicksonfjorden. Tentative stratigraphic correlations based on subjective pattern recognition. Stratigraphic levels relative to base of overlying Middle Carboniferous Limestone.
Dicksonfjorden terminates into the Isfjorden and to the north continues into the Dickson Valley. The proposed N–S running normal fault may be related to the development of the post-Devonian N–S striking Billefjord fault system some 20 km to the east, which constitutes the eastern boundary of the Central Graben on Spitsbergen, within which the Devonian red bed succession is confined.

PALAEOMAGNETIC IMPLICATIONS

A detrital origin of remanent directions carried by hematite would imply an uncertainty with regard to the effect of inclination errors. DRM in hematite records the true azimuth of the ambient magnetic field, enabling a determination of the meridian of the palaeomagnetic pole. The application of palaeomagnetic directions in estimating the sense and magnitude of lateral fault movements may ultimately depend on comparing azimuths of declination.

The poor quality of the obtained distribution of stable directions from the Wood Bay Formation does not permit unambiguous comparisons with European palaeomagnetic poles in order to elucidate the post-Devonian tectonic relationship between Europe and Svalbard. Accepting the proposed detrital origin of the stable directions, it is reasonable to assume that the investigated section of the Wood Bay Formation was deposited and acquired remanent magnetizations in the same geomagnetic field (not necessarily of one polarity). The suggested randomizing effects of the depositional environments cannot be readily quantified, but are likely to be averaged out in the arithmetic mean of the azimuths of all stable directions. The mean azimuth around 240° defines an axis striking some 30° more easterly than the Devonian field axis for stable Europe recalculated to the present-day position of Spitsbergen. The unknown scatter of this inferred Devonian field axis for Spitsbergen may only justify the tentative conclusion of a clockwise rotation of the Central Spitsbergen relative to Europe since deposition in Devonian times.

Conclusion

The large scatter of stable palaeomagnetic directions can hardly be accounted for by magnetic overprinting processes alone. Petrographic and rock magnetic properties suggest a detrital origin of granules of hematite deposited in environments exposed to only minor, if any, post-depositional oxidization. Almost coinciding azimuths of remanence and maximum axis of susceptibility ellipsoids, also suggests a DRM origin residing in hematite. The large spatial variations of stable directions both between and within sites are attributed to randomizing effects caused by the high energy (hydrodynamic) environments acting during the accumulation of the Wood Bay Formation silt-sand sediments. It should be emphasized that post-depositional realignment on detrital hematite is likely to be strongly dependant on depositional environments (currents, floods) due to the weak magnetic torque acting on such grains.

Although the inferred influence of the proposed randomizing effects on the remanence directions due to the high energy depositional environments is rather conjectural, the almost symmetrical NE–SW distribution of stable directions (cf. Fig. 7) is tentatively concluded to reflect the geomagnetic meridian during accumulation of the Wood Bay Formation. This inferred Devonian axis for Spitsbergen strikes some 30° more easterly than the corresponding Devonian palaeomagnetic meridian for Europe. Taking into account the involved uncertainties, the result is nevertheless suggested to indicate a post-Devonian clockwise rotation of Central Spitsbergen relative to Europe.
Magnetic hematite in Devonian red beds

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