Introduction

Mesters Vig is located in the northern part of the Jameson Land Basin in central East Greenland. The area is known to host the only ore deposit which has been mined in East Greenland. The Blyklippen mine produced 545,000 t of ore between 1956 and 1962 with 9.3% Pb and 9.9% Zn and still has unexploited resources (Harpøth et al., 1986). In this study we analyse aeromagnetic data over Mesters Vig to map geological domains and structural trends not always observed in outcrops and potentially associated with mineralization. The Total Magnetic Intensity as well as the transformations of the total field allowed to identify faults, dykes and sills, to define structural relationships between them and to delineate trends along which some epithermal Pb-Zn sulphide-bearing quartz veins occur.

Jameson Land Basin and Mesters Vig area: geology and mineralization

The Jameson Land Basin is bounded to the West and to the East by Caledonian basement rocks (Figure 1a). During the Late Paleozoic-Mesozoic interval the Jameson Land Basin was filled up with continental and marine sediments. This was followed by break-up magmatism in the Early Eocene due to the opening of the North Atlantic which manifested by a thick pile of Plateau Basalts and by intrusions of basaltic sills and dykes. During the Middle Eocene-Oligocene, alkaline intrusions affected the northern part of the basin, marking a NE-SW trend of plutonic centres that can be followed over 100 km (Henriksen, 2003 and incl. ref.).

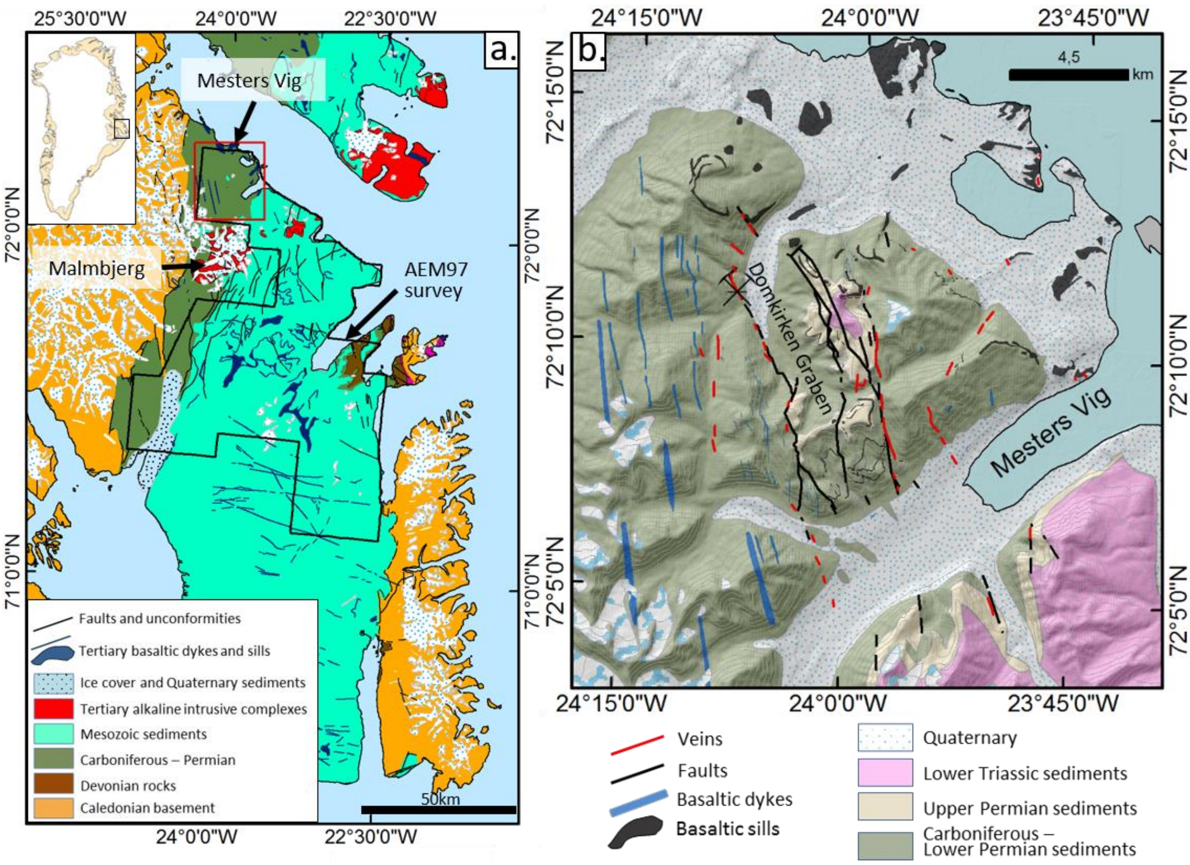

***Figure 1** (a): Simplified geological map of Jameson Land (Henriksen, 2003) showing the distribution of Tertiary intrusive rocks. Black boundary: aeromagnetic survey AEM97. (b): Shaded relief and geological map of the Mesters Vig area (modified after Swiatecki 1981).*

Mesters Vig is located north of Malmbjerg (Figure 1a), one of the alkaline Tertiary intrusions known for its molybdenum porphyry mineralization. In this area a 4 km-wide and 15 km-long NNW-SSE trending graben structure is filled with Upper Carboniferous–Lower Permian continental deposits unconformably overlaid by Upper Permian marine sediments and Lower Triassic shales that are only preserved within the graben. N140-160 and N0-25 trending rift faults accommodated more than 1000 m of vertical displacement. Fault activity has taken place at different times since the Late Carboniferous as the Tertiary sills are much less offset than the Permian strata. Harpøth et al (1986) summarized the Tertiary intrusions occurring in Mesters Vig into 4 groups as follows:

i. lamprophyre dykes (occurring in the southwest) up to 5 m-wide cross-cut by quartz veins and doleritic dykes;
ii. doleritic sills (outcropping in most of Mesters Vig area) up to 100 m-thick cross-cutting quartz veins and cross-cut by N-S, NNE-SSW and NNW-SSE faults;
iii. doleritic dykes, subvertical, N160-180 trending, 0.1-4 m-thick (widespread over Mesters Vig but most common in the western part) cross-cut quartz veins and sills;
iv. doleritic dykes, subvertical, N20-30 trending, 2 m-thick (southeastern part of Mesters vig area) locally cross-cut the doleritic dykes oriented N160-180.

Mineralization occurs as epithermal sulphide-bearing veins covering an area of 300 km^2. They comprise quartz, barite, galena and sphalerite with minor calcite, pyrite and chalcopyrite. The epithermal veins can be up to 1000 m long and 70 m wide and are widespread over Mesters Vig but two major vein zones occur along the border faults on both sides of the graben (Figure 1b). The mineralization phase is thought to be Tertiary in age and related to hydrothermal activity associated with the Palaeogene alkaline intrusive complexes (Figure 1a). However, a first mineralizing phase in Permian was also postulated since quartz veins have never been observed in stratigraphic layers above Upper Permian (Harpøth et al., 1986).

Aeromagnetic data

Mesters Vig is covered by the AEM97 survey (Figure 1a) with combined magnetic and GeoTEM data collected along E-W lines spaced of 400 m (Geoterrex—Dighem, 1997) which offers a good resolution to map basin-scale structures. The first vertical and the tilt derivatives calculated from the total magnetic field data (Figure 2a and b) are useful to map structural trends. The tilt derivative enhances weak magnetic anomalies and the vertical derivative enhances the linear structures. The analytic signal (Figure 2c) is useful to outline the location of magnetic source bodies and has the advantage of not being subjected to shift of the anomalies.

The Mesters Vig area is located in a magnetic low (Figure 2a). N-S trending lineaments can be correlated with the doleritic dykes oriented N160-180 mapped in the western part of the area. NNE-SSW trending magnetic lineaments observed in the southern part are correlated with the doleritic dykes oriented N20-30 southeast of Mesters Vig, also descibed by Harpøth et al. (1986). These magnetic trends are also visible in the northeastern part where only few dykes were mapped. Their magnetic signal is attenuated in the central part but can still be observed on the vertical derivative and the tilt derivative maps (Figure 2a and b). They are furthermore enhanced on Figure 2b where a shaded relief with an illumination orthogonal to their direction was applied. On the magnetic data, no distinct cross-cutting relationship is observed between the N-S trending and the NNE-SSW trending dykes as it is described in Harpøth et al. (1986). It rather seems that the orientation of the dykes changes gradually from N-S to NNE-SSW over the area. These lineaments appear to be locally cross-cut by NE-SW magnetic trends defining a 3 km-wide zone in the southern part of the Domkirken Graben (Figure 2d). These trends have the same orientation than the local bending in the western border fault of the Domkirken Graben. Furthermore, another NE-SW magnetic trend is observed in the western prolongation of Mesters Vig and will be referred to as the Mesters Vig Fault (Figure 2).

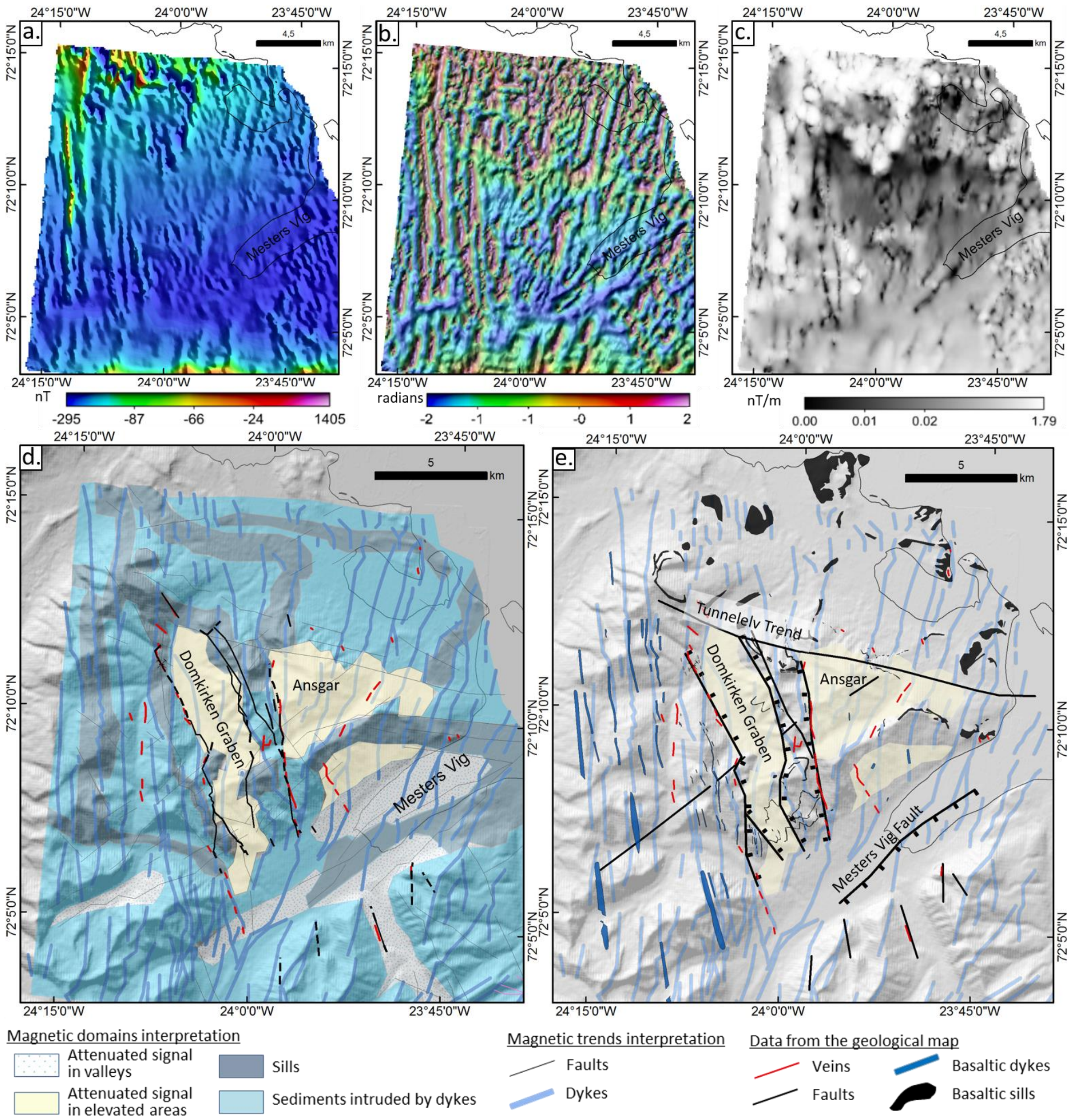

***Figure 2** a, b and c: Aeromagnetic data from the AEM97 survey over Mesters Vig (a) pseudocolour of the Residual Magnetic Field (RMF) on the shaded relief of the first vertical derivative (shaded relief illuminated from the northeast); (b) pseudocolour shaded relief of the Tilt Derivative of the RMF (shaded relief illuminated from the northwest); (c) grey-scale of the analytic signal; (d) interpretation of the magnetic domains and structural trends (e) map of the main structures and domains interpreted from the magnetic maps.*

Four magnetic domains are outlined from the magnetic maps (Figure 2d):(1) areas where magnetic lineaments occur and are associated with sediments intruded by dykes; (2) magnetic domains associated with maxima on the analytic signal map as well as continuous tortuous anomalies occur in almost the entire area and are often correlated with sills in the geological map. These domains are overprinted by the N-S to NNE-SSW trending dykes' signal; (3) magnetic domains with attenuated signal observed within valleys where Quaternary sediments outcrop; (4) magnetic domains with attenuated signal observed in elevated areas. These are associated with minima in the analytic signal map indicating deeper magnetic sources than in the neighbouring areas (Figure 2c).

Within the Domkirken Graben a thick sedimentary pile is preserved and corresponds to the magnetic domain 4. Locally, two maxima on the analytic signal map (Figure 2d) reflect a shallower magnetic source which may be due to the presence of sills intruding the Permian sediments. In the magnetic domain 4 observed over Ansgar (Figure 2d) only few dykes intrude the Carboniferous sediments, additional filtering on the magnetic data was necessary in order to delineate magnetic trends. The Ansgar low magnetic domain is bordered to the South by the Mesters Vig Fault and, together with the Domkirken graben, is cut to the North by a series of WNW-ESE trends. These trends crosscut the entire area and are simplified as the Tunnelelv Trend on Figure 2e.

Conclusions

In the Mesters Vig area doleritic dykes were mostly mapped in the western part of the Domkirken Graben (Swiatecki 1981) and are found to be associated with magnetic lineaments allowing to delineate them over the entire area. The aeromagnetic daa allowed to identify the Mesters Vig Fault and associated NE-SW trending faults occuring further north where they crosscut the doleritic dykes. The Tunnelelv Trend defined from the magnetic data is cutting the Domkirken Graben to the North. Finally, aeromagnetic data allowed here to outline subcropping magnetic domains and delineate structural trends along and in the vicinity of which mineralized quartz veins are mapped.

Acknowledgements

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