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# Magnetic anomalies of mineralized cover of the Strzelin granitoids

ABSTRACT: The crystalline schists from metamorphic cover of the Strzelin granitoids (Lower Silesia), mineralized with iron and titanium oxides, reveal anomalies $\Delta Z$ which were analyzed by laboratory measurements of magnetic properties of these rocks. The analysis was supplemented by field and microscopic studies. It made possible to reconstruct the geological setting and distribution of mineralized schist zones, as well as to quantify the content of ore minerals.

## INTRODUCTION

The paper presents the results of detailed mapping of anomalies $\Delta Z$ of intensity of the Earth magnetic field, made in the zone of crystalline schists exposed in central part of the Strzelin granitoid massif (Lower Silesia). The schists, composed of sillimanite, mica, quartz, microcline (Bereś 1969) and andalusite (Nowakowski *in* Olszyński 1972), belong to the formation dated at the Proterozoic and early Paleozoic, and overthurst upon the Variscan Strzelin granitoids (Oberc 1966; Wójcik 1968). In some parts of the schist formation, the presence of titanomagnetite replaced by martite, and of ilmenite and hematite aggregates was stated (Olszy ski 1972).

## LABORATORY MEASUREMENTS

Laboratory measurements (Table 1) have shown that the magnetic susceptibility of the mineralized schists is generally in direct proportion to the percentage of ore minerals.

Remanent magnetization vector shows variable orientation, presumably mainly because of original differentiation in magnetization

Table 1

**Magnetic properties of investigated samples**

| Number of sample | Mean value of magnetic suscepti-bility $\varkappa \cdot 10^6/4\pi$ in SI units | Remanent to induced magnetization intensity ratio Q | Remanent magnetization vector | | Contents of ore minerals (% vol.) | Ilmenite-hematite to titano-magnetite ratio | Degree of anisotropy in magnetic susceptibility $P = \frac{\varkappa_{max}}{\varkappa_{min}}$ |
|---|---|---|---|---|---|---|---|
| | | | azimuth | incli-nation | | | |
| 1 | 860 | 12.44 | 33°E | +45° | 2.7 | 4 : 1 | 3.33 |
| 2 | 780 | 5.05 | – | – | 2.3 | 1 : 8 | 1.84 |
| 3 | 3800 | 16.40 | 17°W | –27° | 15.2 | 1 : 10 | 1.24 |
| 4 | 1800 | 1.72 | 22°E | –22° | 7.5 | 1 : 9 | 1.31 |
| 5 | 140 | 3.43 | – | – | 2.0 | 1 : 8 | 1.59 |
| 6 | 3400 | 0.63 | 48°W | –15° | 11.6 | 1 : 11 | 1.17 |
| 7 | 1400 | 0.84 | 51°W | –24° | 5.1 | 1 : 11 | 1.15 |

direction resulting, in turn, from differences in values of Curie point for titanomagnetite and ilmenite-hematite (*cf.* Nagata & Uyeda 1955; Runcorn 1956). Moreover, this variability in orientation of the vector also results from tectonic processes (the phenomenon of magnetostriction) as well as from physico-chemical processes leading to the replacement of magnetite by hematite (martite). The instability of the remanent magnetization of mineralized schists is also reflected by the low remanent magnetization/induced magnetization ratio (*Q*).

The discussed processes resulted in a remarkable differentiation in the value and direction of remanent magnetization vector, found even on small distances, and finally in a decrease in value of resultant vector of that magnetization. It may therefore be assumed that the magnetic field values obtained primarily depend on induced magnetization of the Earth magnetic field.

The degree of anisotropy of magnetic susceptibility (*P*) for samples primarily consisting of titanomagnetite ranges from 1.0 to 1.5, being markedly higher for sample No. *1*, mostly consisting of ilmenite-hematite (*cf.* similar observations by Nagata 1961).

Magnetic susceptibility measurements taken for granitoids, granitogneisses, quartzites and pegmatites from the investigated area, gave hardly detectable values, which is in accordance with the previous records (Reich 1933).

## GEOLOGICAL INTERPRETATION OF ANOMALIES $\Delta Z$

Analysis of anomalies $\Delta Z$, based on the results of field and laboratory studies, has shown that the positive anomalies are confined to the zones of occurrence of mica-sillimanite-andalusite schists mineralized with titanomagnetite, ilmenite-hematite and martite (*cf.* Figs 1—3). Since the intensity of these anomalies appeared primarily related to the percentage of ore minerals, it was possible to distinguish zones enriched in these minerals, i.e., with contribution of ore minerals equalling 10—15% of rock volume, and zones where the contribution equals 10—2% of rock volume (Fig 2).

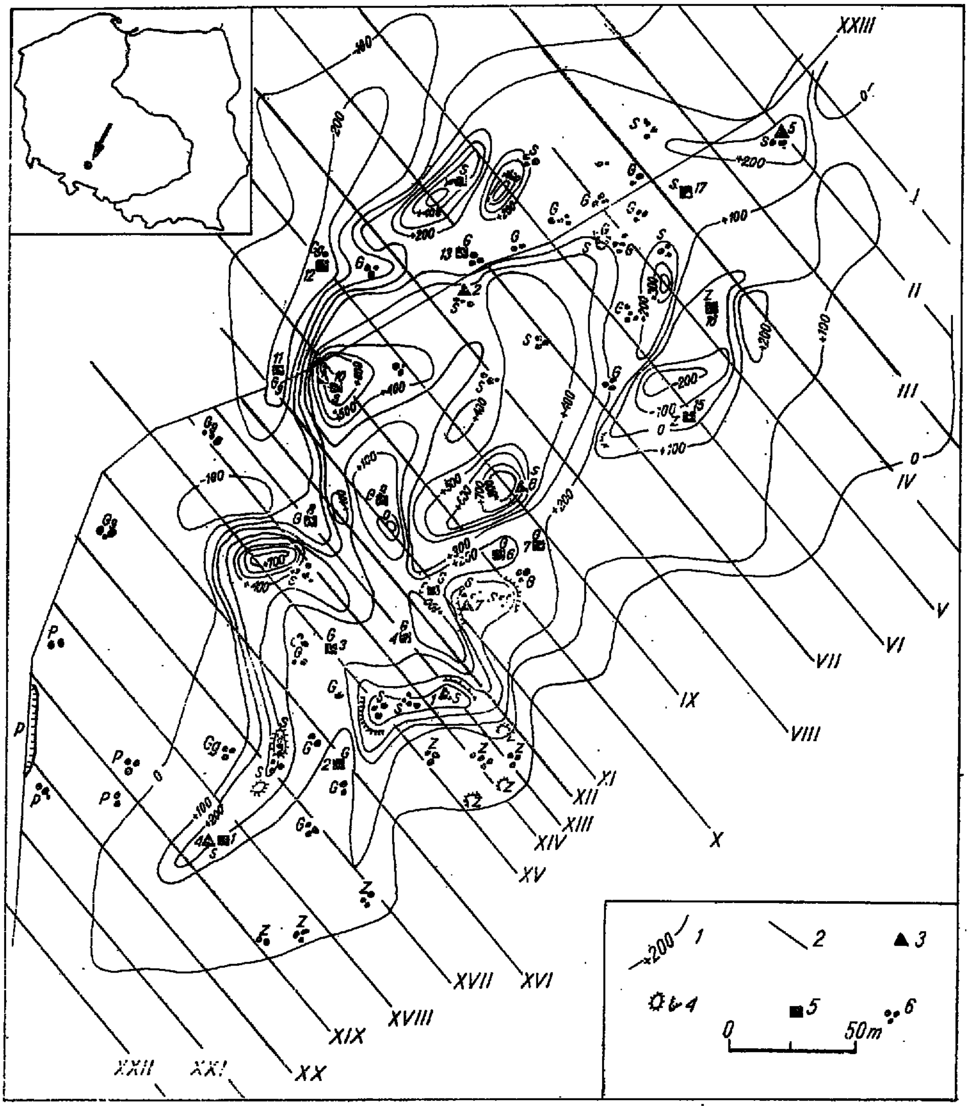


Fig. 1. Magnetic anomalies $\Delta Z$ in the ore-bearing zone in schists covering the Strzelin granitoids (geological data including)

1 isoanomals $\Delta Z$ in $\gamma$, 2 magnetic profiles, 3 sampling sites for magnetic properties, 4 exposures, 5 trenches, 6 loose blocks

G granitoids, P pegmatites, Gg granitogneisses, S mica-sillimanite-andalusite schists with ore minerals, Z quartzites

The Strzelin granitoids occur in zones of lowered values of anomaly $\Delta Z$, stretching between the zones of positive anomalies. The granitoids were found at the locality No. *XII* and in trenches No. *1–9* and *13* (Figs 1–2).

A monotonous image of anomalies $\Delta Z$ with values 100–200 $\gamma$, visible in northern part of the mapped area, is related to the occurrence of

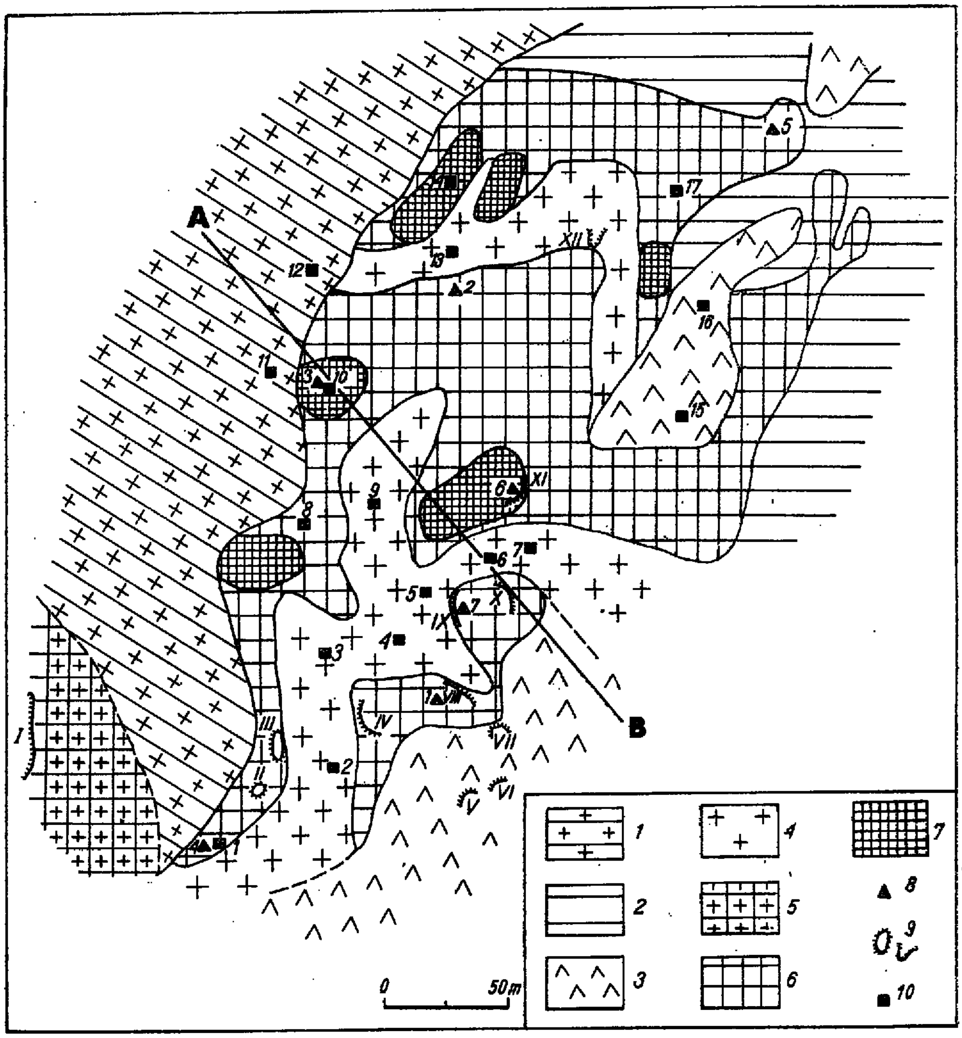


Fig. 2. Geological sketch-map of the zone of ore-bearing schists near Strzelin
Precambrian — older Paleozoic: *1* granitogneisses, *2* mica-sillimanite-andalusite schists, *3* quartzites;
Younger Paleozoic: *4* granitoids, *5* pegmatites;
*6* mica-sillimanite-andalusite schists containing 2–10% (vol.) of iron and titanium oxides, *7* mica-sillimanite-andalusite schists containing 10–15% (vol.) of iron and titanium oxides; *8* sampling sites for magnetic properties, *9* exposures, *10* trenches
A—B denotes cross-section (Text-fig. 3)

granitoids accompanied by mineralized schists with magnetite largely replaced by martite (trench No. *17*; *cf.* Figs 1—2).

A negative anomaly from north-eastern part of the mapped area is related to quartzites (found in the points *V*, *VII*, *15—16* — see Fig. 2),

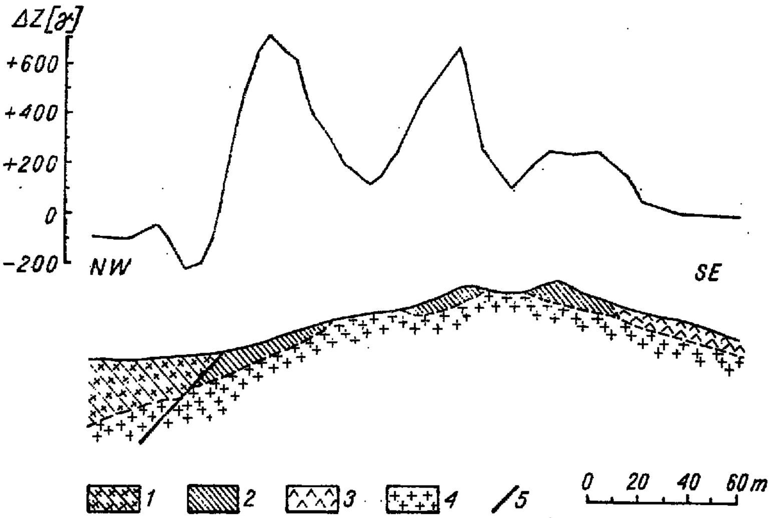


Fig. 3. Schematic cross-section along the magnetic profile No. *X* (*cf.* Text-fig. 2), demonstrating the spacial relationship of main rock-types

*1* granitogneisses, *2* mica-sillimanite-andalusite schists, bearing iron and titanium oxides, *3* quartzites, *4* granitoids, *5* fault

forming a small lenses within the mineralized schists. Low $\Delta Z$ values are related to the schists which occur at the base of the quartzites and act as a lower magnetic pole of the ore body. The quartzites continue in the south-western direction (Fig. 2) extending outside the area studied.

The area to the west of the field delineated by 0-isoanomaly corresponds to the exposures of granitogneiss and pegmatite (*cf.* points *I*, *11—12* in Fig. 1). The rocks are characterized by similar magnetic susceptibility, so their boundary was delineated on the basis of results of field studies and data taken from geological map.

Negative anomalies from the granitogneiss zone, directly contacting with high positive $\Delta Z$ anomalies (Fig. 1), are related to the action of a deeper-seated magnetic pole of the ore body. It is assumed that in this area the mineralized schists plunge approximately to north-west, beneath granitogneisses, along a tectonic contact (*cf.* Fig. 3).

## FINAL REMARKS

The results of the presented studies show that the mineralized mica-sillimanite-andalusite schists represent a direct cover of Strzelin granitoids occurring at shallow depths and intruding the cover. Iron and titanium oxides are primarily concentrated close to the contact between the granitoids and the cover, and they appear in small and relatively poorly mineralized bodies.

The area studied is situated in an occurrence zone of a few positive anomalies with values up to a few hundred $\gamma$, marked in the eastern part of the Fore-Sudetic block (*cf.* Dąbrowski 1969). The anomalies may be related to the occurrence of mineralized crystalline schists similar to those of the Strzelin massif.

Taking into account the repeated records of similar rocks yielding a few to several tens of per cent of iron oxides from the Sudetes Mts (*cf.* Majerowicz & Sawicki 1958; Fedak & Lindner 1966; Zimnoch 1967) it is assumed that the occurrence of such rocks should be considered in interpretations of magnetic anomalies of the Sudetes and Sudetic Foreland.

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