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**THE JAWORNICKIE GRANITOIDS: MAGNETIC FABRIC AND
RELATIONSHIP WITH THE ŻŁOTY STOK-SKRZYNKA SHEAR ZONE**

INTRODUCTION

Structural studies of igneous bodies always raise the question of the magmatic or tectonic solid-state flow origin of the foliation. Furthermore, magmatic fabrics in plutons may form in response to internal chamber dynamics and/or to tectonic movements coeval with magma emplacement (Paterson and Vernon, 1995). Distinguishing structures formed by magmatic flow from those formed by tectonic processes is critical for understanding the timing and means of emplacement of plutons, which in turn influence interpretation of the evolutionary history of the country rocks. The measurement of the magnetic fabric of rocks is a frequently used method to obtain structural data on rocks which appear to be macroscopically isotropic or in which recognition of foliations or lineations in the outcrops can be difficult due to the lack of suitable surfaces.

This paper presents a study of the magnetic fabric of Variscan granitic dyke-like and elongated plutons of small size which occur within the multiply deformed rocks of the Żłoty Stok – Skrzynka shear zone (ZS-SSZ). Determination of the anisotropy of magnetic susceptibility (AMS) allows us to detect systematic changes of several magnetic parameters which provide valuable information on kinematic reconstruction of the Jawornickie granitoids emplacement and deformation.

GEOLOGICAL SETTING

The Jawornickie granitoids form a string of elongate subconcordant plutons, striking NNE-SSW. These sheeted-bodies are interpreted as dykes and sills injected parallel to the ZS-SSZ and dykes evolving into sills are observed locally. The ZS-SSZ is an 10 km long (minimum length) near vertical shear zone, in northern part terminated by Sudetic Boundary Fault and by H. Cloos (1922) was linked with the Niemcza shear zone, located about 20 km farther to the north. The Jawornickie granitoids intruded a sequence of polymetamorphic metavolcanic and metapelitic rocks which dominant fabric has been developed under conditions

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typical of high-temperature amphibolite facies – $T=650-700^{\circ}\text{C}$ and $P=2.0-2.5$ kb (Kozłowska-Koch, 1973; Smulikowski, 1979). A distinctive strain aureole is not well developed; a foliation in the country rocks attributable to the pluton emplacement is lacking. The temperatures estimates for the granitoids in question derived from the calibration of edenite-richterite reaction of Holland and Blundy (1994), considered to be the lowest and most reliable, yield $660-730^{\circ}\text{C}$. Al-in-hornblende barometer is not precise method for determining depth of formation. However as numerous analyses yield similar results, $\sim 5,5$ kbar, the reliability of the data increases considerably. This values suggest that the level of emplacement of the Jawornickie granitoids was in the range of 18-23 km. The macroscopic fabric of the pluton is characterized by a foliation trending NNE-SSW, parallel to the longest dimension of the pluton. The dips of the foliation are generally moderate to steep. At the outcrop scale, the foliation is usually defined by small biotite flakes and/or hornblendes that form only weakly or unconnected layers and sometimes anastomose around elongate quartz grains and feldspars. Microstructures present in the intrusive suite indicate deformation by magmatic flow and high temperature, solid state plastic flow as well as, locally, low temperature ductile/brittle shear zones. Associated with the planar-linear fabric there are S/C and other asymmetrical structures indicating a non-coaxial flow with a left-lateral sense of movement.

METHODOLOGY

Two accurately oriented hand samples were collected in the field at each of the 43 stations of jawornickie granitoids and 5 stations of country rocks. Rocks cylinders, 25 mm in diameter, were cored and oriented in the lab. A minimum of two cores were drilled in each sample and were cut into 22 mm-long specimens, and so 395 samples were measured. The KappaBridge KLY-3S and KLY 2 susceptometers (Geofizyka Brno) were used to measure magnetic susceptibility magnitude (MS) and anisotropy of magnetic susceptibility (AMS) for each specimen.

RESULTS

Because of its low susceptibility (K_{mean} show values of $0.5-1.5 \times 10^{-4}$ SI units), the Jawornickie granitoids can be considered as a ‘non-magnetic’ granite according to the classification of Ellwood & Wenner (1981), and as a rock essentially composed of paramagnetic minerals with only subordinate influence of ferromagnetic components. Such low values of magnetic susceptibility are typical of S types granites. The degree of anisotropy P' in the Jawornickie granitoids ranges from 2.5 to 22% with the majority of stations exhibiting values from 5 to 15%. According to this the degree of anisotropy for most of the samples is well defined pointing to a distinct magnetic fabric of the samples. There is a weak correlation between P' and K_{mean} , showing that the role of distribution anisotropy and magnetic particle interaction is minimal. No correlation can be established between the degree of anisotropy, the bulk susceptibility and the sample location in

the pluton. The shape of the magnetic ellipsoids of the samples shows great differences in their values. They range from nearly perfectly oblate to nearly perfectly prolate, still the majority of the samples exhibits values that concentrate in the field moderately samples. Again no clear correlation of the shapes of the magnetic ellipsoids according to their position in the Jawornickie granitoids can be established. There is a weak correlation between the magnetic shape factor and degree of magnetic anisotropy, i.e., the ellipsoid shape is not a function of magnetic fabric intensity.

In general mean AMS foliations for hand samples dip at moderate to steep angles to N-NW and roughly parallels the outer margin of the pluton. At the site' scale AMS planar fabric shows good correlation with mesoscopic tectonic foliations. The lineation is shallowly plunging to SW, although some stations have trends perpendicular to this general one. Those sampling points with NW lineations occur in some isolated locations in the northern part. A dominant NE-SW trend of shallowly plunging magnetic lineations is reinforced and is attributed to magma stretch along this direction during pluton emplacement within its overlaying rocks.

CONCLUSIONS

1. Magnetic fabric results from a combination of both magmatic and high-temperature solid-state flows.
2. Magnetic fabric show good correlation with dominant tectonic foliation.
3. The fabric with foliations mostly steep and parallel with major shear zones combined with generally subhorizontal lineations suggests an origin of the Jawornickie granitoids in a strike-slip tectonic regime.

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