Annales Societatis Geologorum Poloniae (2002), vol. 72: 241–253.

RADIOMETRIC DATING OF THE TERTIARY VOLCANICS IN LOWER SILESIA, POLAND. III. K-Ar AND PALAEOMAGNETIC DATA FROM EARLY MIOCENE BASALTIC ROCKS NEAR JAWOR, FORE-SUDETIC BLOCK

Krzysztof BIRKENMAJER[1], Zoltán PÉCSKAY[2], Jacek GRABOWSKI[3], Marek W. LORENC[4] & Paweł P. ZAGOŻDŻON[5]

[1] *Institute of Geological Sciences, Polish Academy of Sciences, Cracow Research Centre, Senacka 1, 31-002 Kraków, Poland; e-mail: ndbirken@cyf-kr.edu.pl*

[2] *Institute of Nuclear Research, Hungarian Academy of Sciences, Bem tér. 18c, 4001 Debrecen, Hungary; e-mail: pecskay@moon.atomki.hu*

[3] *Polish Geological Institute, Rakowiecka 4, 00-975 Warszawa, Poland; e-mail: jgra@pgi.waw.pl*

[4] *Institute of Geological Sciences, Polish Academy of Sciences, Sudetic Geology Department, Podwale 75, 50-449 Wrocław; e-mail: mwlorenc@twarda.pan.pl*

[5] *Faculty of Mining, Wrocław University of Technology, Wybrzeże Wyspiańskiego 27, 50-370 Wrocław, Poland e-mail: Pawel.Zagozdzon@ig.pwr.wroc.pl*

Birkenmajer, K., Pécskay, Z., Grabowski, J., Lorenc, M. W. & Zagożdżon, P. P., 2002. Radiometric dating of the Tertiary volcanics in Lower Silesia, Poland. III. K-Ar and palaeomagnetic data from Early Miocene basaltic volcanics near Jawor, Fore-Sudetic Block. *Annales Societatis Geologorum Poloniae*, 72: 241–253.

Abstract: The K-Ar dating of Tertiary basaltic rocks near Jawor, Lower Silesia (Poland), included the sites at Winna Góra (plug) and at Męcinka (lava flow, and vent/dyke), well exposed in working quarries. According to new geochemical data, these rocks, classified so-far as trachyandesites, have been reclassified as basanite and olivine basalt. Early Miocene (Aquitanian) K-Ar ages, have been obtained from the basanite lava flow at Męcinka (21.05±0.85 Ma), and from the basanite plug at Winna Góra (21.62±0.93 Ma, and 21.96±1.36 Ma, respectively). An olivine basalt vent/dyke which cuts the lava flow at Męcinka yielded a younger (Burdigalian) K-Ar age (18.66±0.82 Ma). New palaeomagnetic analysis confirmed the results of previous studies that these rocks were magnetized during a reversed regime of geomagnetic field. The basanite (plug and lava) K-Ar dates spread over reversed parts of the magnetozones C6A and C6B. A significantly younger K-Ar date from olivine basalt intrusion might be correlated either with the C5D or the C5E magnetozones.

Key words: K-Ar dating, basaltic rocks (basanite, olivine basalt), palaeomagnetism, Early Miocene (Aquitanian, Burdigalian), Lower Silesia, Poland

Manuscript received 25 June 2002, accepted 19 November 2002

INTRODUCTION

The present paper is a further contribution to a geochronological study of the Tertiary basaltic rocks in Lower Silesia, Poland. It includes the results of K-Ar dating of a volcanic plug at Winna Góra (Winnica), and of a lava flow cut by a younger vent/dyke at Męcinka, in the vicinity of Jawor. These volcanics belong to the eastern branch of the Bohemo-Silesian volcanic belt, part of the Central European Tertiary volcanic province (Fig. 1). They are located in the Fore-Sudetic Block which was downthrown along the Marginal Sudetic Fault with respect to the Sudetic Mts Block (Fig. 2).

This is a result of bilateral co-operation initiated by the Polish Academy of Sciences (Institute of Geological Sciences, Cracow Research Branch) and the Hungarian Academy of Sciences (Institute of Nuclear Research, Debrecen), which began in 1998 aiming at K-Ar dating of the Polish Tertiary volcanics.

Originally, the research project included K-Ar dating of the Miocene (Sarmatian/Serravallian) andesitic intrusions of the Pieniny Mts, Polish West Carpathians (Birkenmajer & Pécskay, 1999, 2000). Since 2000, it has been extended towards a systematic K-Ar age determination of the Tertiary

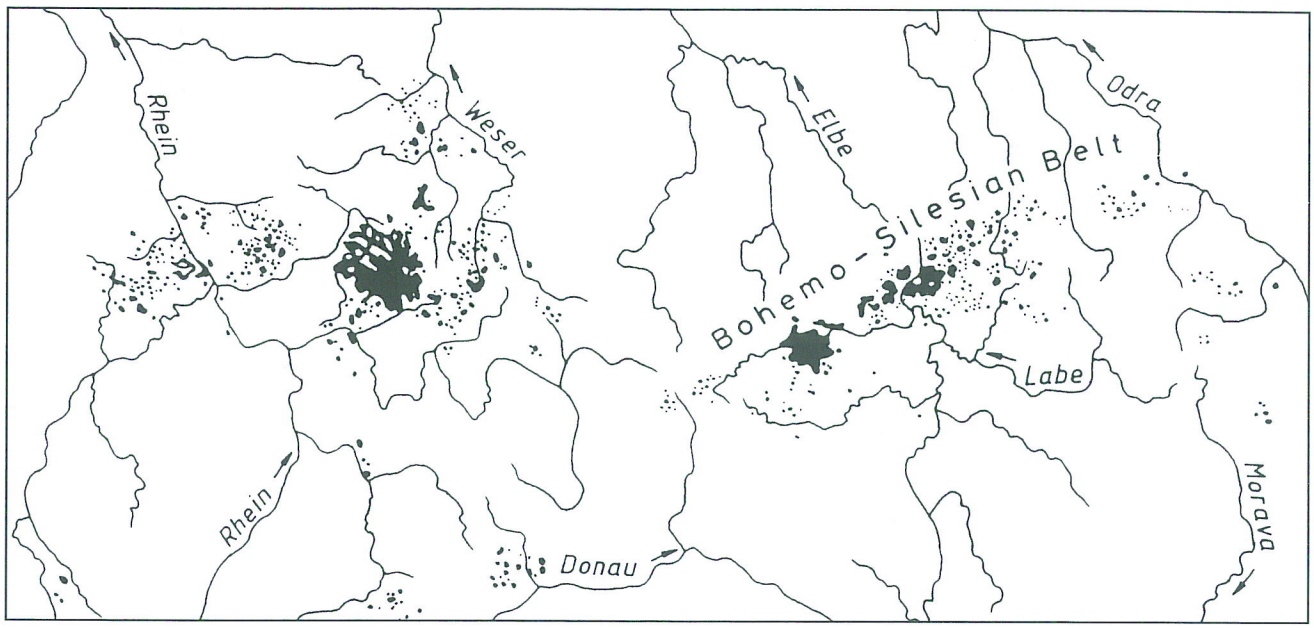

Fig. 1. Basaltic volcanics of the Bohemo-Silesian Belt in Central European Tertiary volcanic province (simplified from Kopecký, 1966)

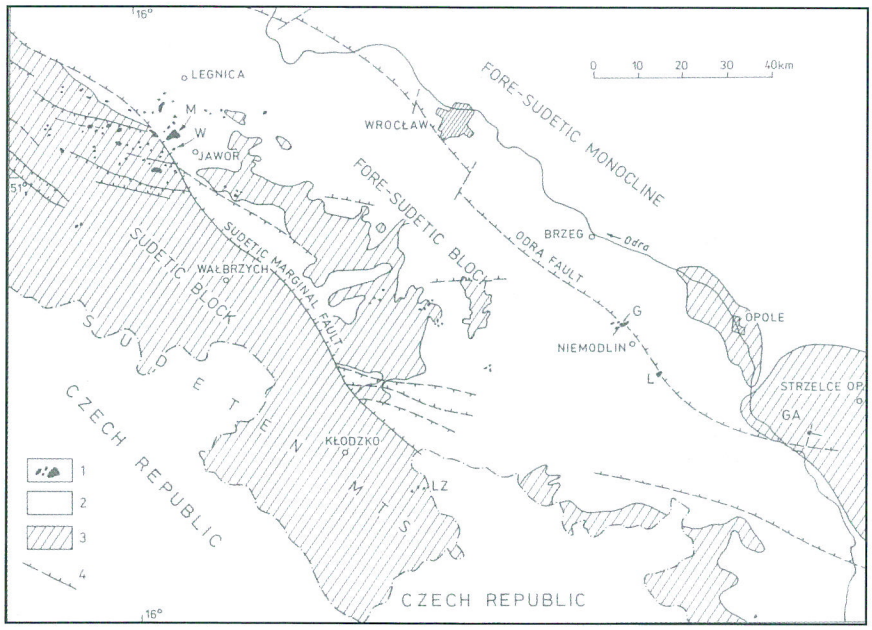

Fig. 2. Location of basaltic sampling sites near Jawor (BP-30-33), in simplified geological map of Lower Silesia, Poland. *1* – Tertiary basaltic rocks; *2* – Cenozoic sedimentary cover; *3* – pre-Cenozoic rocks; *4* – major Tertiary faults; G – Gracze; GA – Góra św. Anny; L – Ligota Tułowicka; LZ – Lądek Zdrój; M – Męcinka; W – Winna Góra (= Winnica)

basaltic rocks in Lower Silesia. The following occurrences of basaltic rocks have so far been elaborated: (I) The Late Oligocene basaltic plugs and lavas of the Opole area, Sudetic Foreland (Birkenmajer & Pécskay, 2002); and (II) The Neogene basanite plug (Messinian/Zanclean) and lava flows (Zanclean) of the Lądek Zdrój area, Sudetes Mountains (Birkenmajer *et al.*, 2002).

The new palaeomagnetic sampling programme initiated in 2001 (Birkenmajer *et al.*, 2002) involves the Polish Geological Institute in Warsaw. It is aimed at supplementing and revising palaeomagnetic data published earlier (e.g., Birkenmajer & Nairn, 1969; Birkenmajer *et al.*, 1970, 1977; Kruczyk *et al.*, 1977, and references therein).

GEOLOGICAL SETTING

In the area of Jawor, there are numerous exposures of the Tertiary basaltic rocks, mainly plugs and lava flows (see Berg, 1930; Wojno *et al.*, 1951; Jerzmański, 1956, 1961, 1965; Birkenmajer, 1967; Birkenmajer & Nairn, 1969; Birkenmajer *et al.*, 1970). The rocks dealt with in the pres-

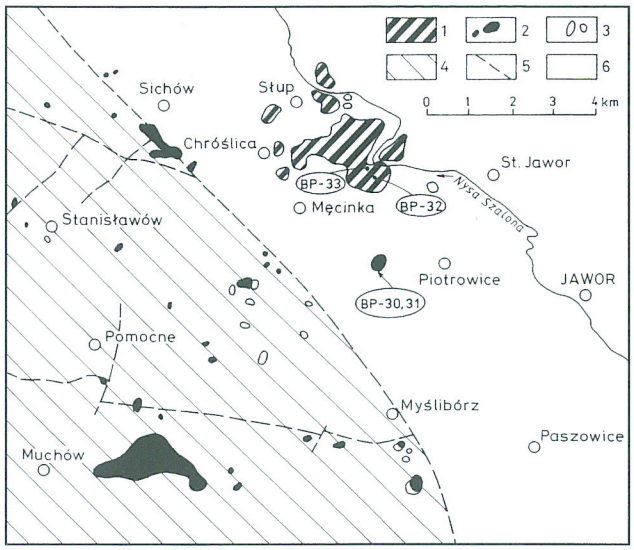

Fig. 3 K-Ar sampling sites in basaltic rocks at Winna Góra (Winnica, BP-30, 31) and Męcinka (BP-32, 33) near Jawor, Lower Silesia (simplified geological sketch from Birkenmajer *et al.*, 1970, fig. 3). *1* – lava flows; *2* – volcanic plugs; *3* – tuff and tuff agglomerate; *4* – Lower Palaeozoic rocks of the Góry Kaczawskie Mts; *5* – faults; *6* – Quaternary cover

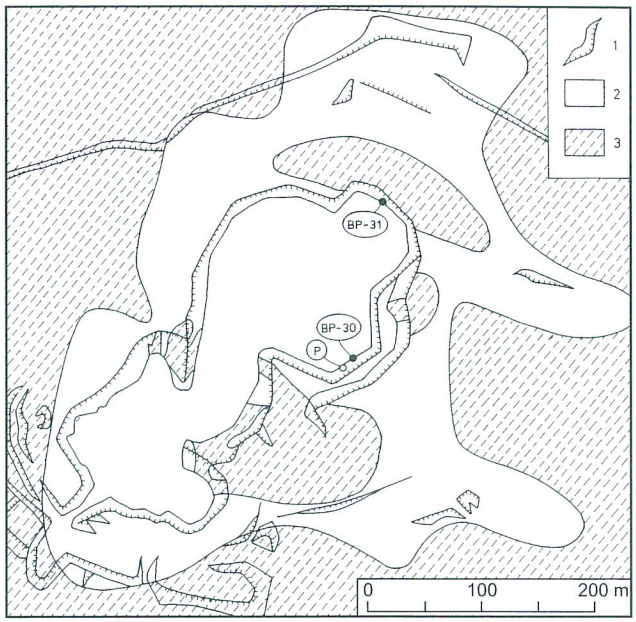

Fig. 4. Winna Góra (= Winnica), working quarry (after Zagożdżon, 2001, simplified), showing location of the K-Ar dated (BP-30, 31) and palaeomagnetic (P) samples

ent paper are well exposed in large working quarries at Winna Góra (= Winnica) and Męcinka, both situated in the Fore-Sudetic Block, immediately north-east of the Marginal Sudetic Fault (Figs 2, 3). Their importance for the history of Tertiary vulcanictity in Lower Silesia lies in the fact that they were the first basaltic rocks ever dated by radiometric techniques (at Early Oligocene – Urry, 1936) and, according to borehole data, the lavas were underlain and overlain by Oligocene sediments (Jerzmański, 1956, 1961, 1965).

SAMPLING DATA

Winna Góra (BP-30, 31)

Geology. This is a volcanic plug associated with lava flows, well exposed in a large working quarry (= Winnica, site 3: Birkenmajer & Nairn, 1969; Birkenmajer *et al.*, 1970; Zagożdżon, 2001) – Fig. 4. The plug, some 300 m across, is situated some 1.5 km NE of the Marginal Sudetic Fault (see Jerzmański, 1956, 1961, 1965; Birkenmajer, 1967). The rock shows vertical or steeply inclined thermal jointing in form of irregular columns 0.1–0.5 m across. Some parts of the plug are reddened, possibly as an effect of post-intrusion weathering.

Sampling. Samples BP-30 and BP-31 were collected from the eastern and the north-eastern parts of the quarry, respectively. Samples for palaeomagnetic investigations were collected in the eastern part of the quarry (see Fig. 4).

Petrology and geochemistry. The rock was originally determined as trachyandesite (Jerzmański, 1956, 1961, 1965), later – as alkali basalt-hawaiite (Kozłowska-Koch, 1965). New petrologic investigations show that this nearly black rock exhibits porphyritic structure, containing groundmass composed chiefly of very fine-grained plagioclase with very distinct albitic twins, moreover of partly chloritized augite and relatively abundant opaque minerals. Interstitial spaces are often filled with brownish-green glass. Olivine is the most common phenocryst; usually, it is cut by irregular network of very fine cracks filled with a green secondary mineral of serpentine group (Fig. 5A, B). Augite phenocrysts are either strongly chloritized or (in sample BP-31) fresh; in the latter case they are sometimes twinned. Both types of phenocrysts are less than 1 mm in size. Aggregates of xenomorphic quartz grains may also be found. Deuteric alteration of the rock is very well marked by red iddingsite rims around most of olivine phenocrysts.

Based on mineral and chemical composition of the studied rocks (Tab. 1), and using the IUGS standard of systematics of igneous rocks (Le Bas & Streckeisen, 1991), we classify them as basanites close to alkali basalts (Figs 6, 7). In our opinion, there is no ground to classify them either as trachyandesite (*sensu* Jerzmański, 1956, 1961, 1965) or hawaiite (*sensu* Kozłowska-Koch, 1987).

The above classification based upon mayor elements has not been confirmed by that based on trace elements (cf. Winchester & Floyd, 1977), in which our basanite samples (BP-30-33) plot as alkaline basalts (Fig. 8). However, contents and proportions of Nb, Y and Zr, which are very indicative immobile elements, are typical for alkaline within-plate basaltoids (Figs 9–11).

Męcinka (BP-32, 33)

Geology. A lava flow, some twenty or so metres thick, classified as trachyandesite by Jerzmański (1956, 1961, 1965; see also Birkenmajer & Nairn, 1969; Birkenmajer *et al.*, 1970: Męcinka E and W, sites 1 and 2, respectively), is well exposed in large working quarry about 0.5 km wide (Fig. 12). The flow exhibits thick thermal columnar jointing well recognizable in the north-eastern and northern parts of