# PALEOMAGNETISM AND NEW K–AR AGES OF THE POHORJE IGNEOUS ROCKS

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**Abstract:** Paleomagnetic results were obtained from different members of the crystallisation succession of the Pohorje pluton as well as the dacite stock. The formers may be interpreted in terms of clockwise rotation and tilting during uplift. The latters must reflect the young-Miocene or Pliocene regional rotation of the part of the Eastern Alpine domain in which the Pohorje pluton had become incorporated.

**Key words:** Pohorje, igneous rocks, uplift, K-Ar ages, paleomagnetism, rotation.

In NE Slovenia there is a continuation of the Periadriatic line, separating the Eastern Alps from the Southern Alps and the Dinarides. The Pohorje igneous body (Fig. 1.) lies N of and is aligned with the Periadriatic line. It was emplaced along deep extensional fractures and was probably generated by crust melting due to thermal relaxation that follows collision. The uplift of the Pohorje is a consequence of post-compressional extension.

The larger SE part of the Pohorje igneous area consists of granodiorite (intermediate plagioclase, quartz, K-feldspar, and biotite with pronounced parallel orientation), which intruded medium-grade metamorphic rocks, and includes a small gabbro (cizlakite) body. Both contain mafic xenolites and are crosscut by aplite and pegmatite veins. Lamprophyre dykes intrude metamorphic rocks, granodiorite and displace aplitic and pegmatite veins. According to field observation the crystallisation succesion is cizlakite, granodiorite,

pegmatite, aplite and lamprophyre. In the NW part of the Pohorje a dacite stock intrudes low-grade metamorphic rocks and thermally affects them.

The relation of dacite to granodiorite is not completely clear, but the former seems to be younger. Field evidence is hard to establish, because of covered contacts.

To solve the problem of the age relationship and to establish the large-scale tectonic evolution of the Pohorje area, paleomagnetic and K-Ar studies were performed.

Conventional K-Ar dating was carried out on "whole rocks" and monomineralic fractions (biotite, feldspar and hornblende). Based on "whole rock" ages (15.0-16.0 Ma) some rejuvenation of most the rocks is highly probable. On the other hand "excess Ar" was found in cizlakite. The most reliable ages were obtained on fresh biotites (18.0-16.5 Ma). Further analytical work is needed to establish age difference between the granodiorite suite and the dacites.

Paleomagnetic and magnetic anisotropy studies were carried out on the granodiorite suite as well as on dacites. The paleomagnetic directions obtained for the dacites fit the regional pattern of CCW rotation of the surrounding Miocene sediments. However, the pluton is characterized by a paleomagnetic pattern of its own, which may be interpreted as reflecting the rotation and tilting of the pluton during uplift; the former is clockwise, the latter corresponds to a movement which uplifted more the eastern than the western part of the Pohorje.

Magnetic fabric studies also reveal fundamental differences between the dacite and the granodiorite suite. In the latter the 3 principal susceptibility axes are vertical, E-W and N-S oriented, respectively; the degree of anisotropy is from moderate to extremely high (up to 60 percent, like in metamorphic rocks). In contrast, the degree of anisotropy is as low in dacite (up to 3 percent) as it should be in lavas or in shallow intrusives; the magnetic fabric shows no relation to that of the granodiorite suite, neither is consistent between sampling sites.

From the paleomagnetic and magnetic anisotropy results the following scenario can be reconstructed. The granodiorite pluton started to uplift and rotate clockwise due to transtension characterized by the right lateral shear of the Periadriatic lineament system. Tilting of the pluton must have occurred during the intrusion of the lamprophyre veins. The magnetic fabric of the pluton is of post-tilting age, but still acquired under an overbunden of considerable thickness. The fabric became strongly lineated after the emplacement of the lamprophyre veins, probably as a result of N-S compression (in present coordinates). The dacite intruded after the cessation of the above described processes and the Pohorje became

incorporated in the Eastern Alpine domain which rotated in the CCW sense, probably after the Miocene.

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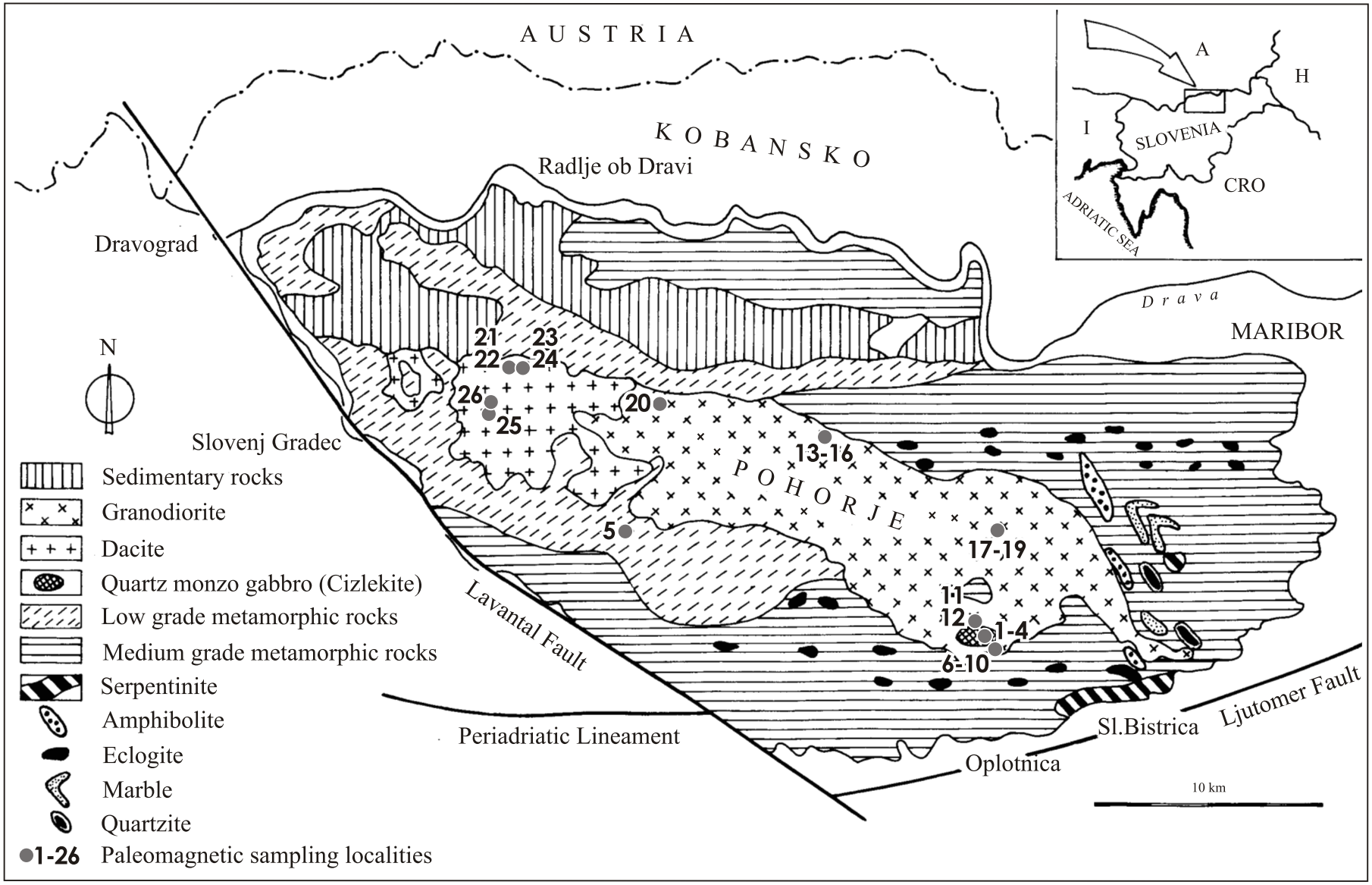
**Fig.1.** Geological sketch map of the Pohorje with the paleomagnetic sampling localities.


AUSTRIA
KOBANSKO
Radlje ob Dravi
Dravograd
Drava
MARIBOR
N
Slovenj Gradec
POHORJE
Lavantal Fault
Periadriatic Lineament
Sl.Bistrica
Ljutomer Fault
Oplotnica
10 km
A
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I
SLOVENIA
CRO
ADRIATIC SEA
21
22
23
24
26
25
20
13-16
5
17-19
11
12
1-4
6-10
Sedimentary rocks
Granodiorite
Dacite
Quartz monzo gabbro (Cizlekite)
Low grade metamorphic rocks
Medium grade metamorphic rocks
Serpentinite
Amphibolite
Eclogite
Marble
Quartzite
1-26 Paleomagnetic sampling localities