Sarmatian sequence Nr. 6. The depocentres shifted to the north and northwest. A wider flooding is documented also at the eastern, and northeastern margin of the basin. The brackish-water deposits of the transgressive and highstand systems tracts are sandy and sandy-clayey. The falling stage of the relative sea level caused the Late Sarmatian isolation, which led to a drop of salinity, and to a progradation of sandy deltaic bodies, lasting until the earliest Pannonian time.

The Pannonian Sequence Nr. 7 started by the infilling of erosional channels on the top of the earliest Pannonian strata. The following brackish-water sequence finished by a total raplacement by alluvial facies in the Late Pannonian.

Geochemistry of Lamprophyres of the Ditrău Alkaline Massif

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Introduction

Lamprophyres are a clan of H_2O and/or CO_2-rich, alkaline rocks ranging from sodic to potassic and from ultrabasic to intermediate. Commonly, they exhibit a distinctive inequigranular texture resulting from the presence of ferromagnesian macrocrysts set in a fine-grained matrix. Irregular to spherical, felsic globular structures are widespread. Lamprophyres typically form en echelon dykes, sills, pipes and vents which may aggregate into extensive swarms or clusters (Mitchell 1989).

The Ditrău Alkaline Massif (DAM) is one of the most diverse and compound geological formations of the Eastern Carpathians. In the past decades numerous scientific essays were published on the complex geological interpretation of the massif, while the origin of lamprophyre dykes intersecting the granitoids, syenitoids and hornblendites of DAM was slightly discussed. So far, only petrographical analyses were performed on the lamprophyre bodies (Herbich 1871, Berwerth 1905, Mauritz 1912, Mauritz et al. 1925, Vendl 1926, Streckeisen 1954, Streckeisen and Hunziker 1974, Anastasiu and Constantinescu 1982, Jakab 1998), hence, the petrological and petrotectonical interpretation of these rocks would be highly contribute to the understanding of DAM's genetics. This paper presents the latest geochemical results of the lamprophyre bodies from the northern part of DAM.

Petrography

The lamprophyre dykes from the DAM show felsic globular structures filled with combinations of carbonates, feldspars and biotite. There are two types of lamprophyres in the studied area: a more abundant melanocratic type with clinopyroxene, edenite-ferroedenite-hastingsite (Pál-Molnár 2000) and biotite phenocrysts and mesocratic varieties with phenocrysts of garnet. The texture is typically porphyritic and panidiomorphic. The fine-grained matrix consisting of the same minerals as the phenocrysts, together with plagioclase feldspar compose 83–100 vol% of the lamprophyres. Accessory minerals are titanite, apatite and Fe-Ti oxides. In the melanocratic dykes the clinopyroxene is uralitized, the edenite-ferroedenite-hastingsite is partially replaced by chlorite-oxide minerals±carbonate±epidote aggregates, the biotite is chloritized and the matrix plagioclase feldspar is sericitized. The garnets of mezocratic samples are totally or partially altered. Latter lamprophyres contain secondary leucoxenic patches and in general are strongly altered both the phenocrysts and the groundmass.

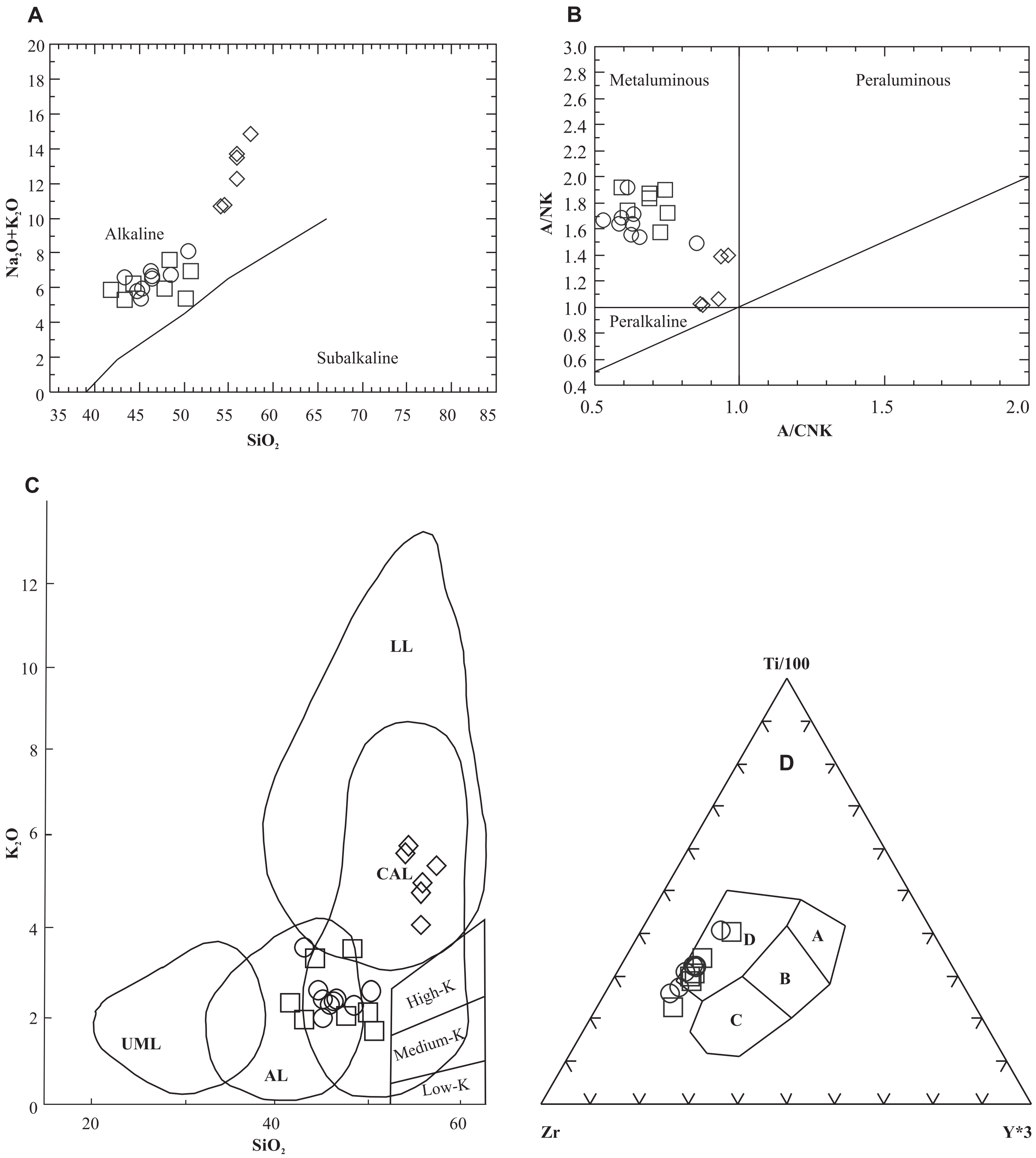
Geochemistry

The whole-rock geochemical analyses were determined with ICP-MS at the Department of Geology and Geochemistry, University of Stockholm.

Lamprophyres are linked together with alkaline rocks by their high average contents of low-field-strength incompatible elements K, Rb, Ba and Sr, but near-basaltic levels of many high-field-strength elements (Ti, Y and heavy REE) and Sc (Rock 1987). Plotting all analyses on standard discrimination diagrams, distribution of lamprophyres show that they are alkaline (Fig. 1A) according to the criteria of Irvine and Baragar (1971) and metaluminous (Fig. 1B) (Maniar, Piccoli 1984). Based on their SiO_2 *vs*. K_2O composition the investigated samples plot in the AL (alkaline lamprophyres) and CAL (calc-alkaline lamprophyres) fields (Fig. C) after Rock (1987). Tectonic classification (Pearce, Cann, 1973) groups the lamprophyres into the continental field (Fig. D) which is in accordance with the intraplate origin of the DAM (Pál-Molnár, 2000).

Conclusion

The lamprophyre dykes from the DAM are melanocratic with clinopyroxene, edenite-ferroedenite-hastingsite and biotite phenocrysts and mezocratic with phenocrysts of garnet. Felsic globular structures are filled with combinations of carbonates, feldspars and biotite. The lamprophyres have alkaline and metaluminous characteristics. According to Rock's classification they are AL (alkaline lamprophyres) and CAL (calc-alkaline lamprophyres). The lamprophyre dyke-swarms have intra-plate origin.



■ **Fig. 1.** (A) SiO_2 *vs.* Na_2O+K_2O, after Irvine and Baragar (1971), (B) $A1_2O_3/(Na_2O+K_2O)$ *vs.* $A1_2O_3/(CaO+Na_2O+K_2O)$, after Maniar and Piccoli (1989), (C) SiO_2 *vs.* K_2O after Gill (1982) comparing whole-rock compositional fields of lamprophyres after Rock (1987), UML – Ultramafic Lamprophyres, AL – Alkaline Lamprophyres, CAL – CaIc-Alkaline Lamprophyres, LL – Lamproites, (D) Ti/100-Zr-Y*3, after Pearce and Cann (1973) A – island-arc tholeiites, B – ocean-floor basalt and island arc tholeiite, C – calc--alcaline basalt, D – continental basalt. ○ Melanocratic lamprophyres from Tarnica Complex (DAM), □ Melanocratic lamprophyres from granitoids (DAM), ‾ Mezocratic lamprophyres from granitoids (DAM).

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References

ANASTASIU N. and CONSTANTINESCU E., 1982. Tectostructural position of the foidic rocks in the Romanian Carpathians. *Rev. Roum., Geol., Geoph., Geogr., ser. Geol.,* 26.

BERWERTH F.M., 1905. Der Eläolithsyenitstock des Pricske bei Gyergyó-Szt.-Miklós und Ditró in der Gyergyó. *Siebenbürg. Karpathenver.,* 25.

HERBICH F., 1871. Északkeleti Erdély földtani viszonyai (Jelentés a m. kir. Földtani Intézet megbízásában végzett földtani fölvételről). *Magyar kir. Földtani Intézet évkönyve,* 284-292.

IRVINE T.N. and BARAGAR W.R.A., 1971. A guide to the chemical classification of the common volcanic rocks. *Can. J. Earth Sci.*, 8, 523-548.

MANIAR P.D. and PICCOLI P.M., 1989. Tectonic discrimination of granitoids. *Geol. Soc. Am. Bull.*, 101, 635-643.

MAURITZ B., 1912. Adatok a gyergyó-ditrói szienittömzs kémiai viszonyainak ismeretéhez. *Mat. term. tud. Értesítő,* XXX: 607-631.

MAURITZ B., Vendl M. and Harwood H.F., 1925. A ditrói szienit további petrokémiai vizsgálata. *Mat. term. tud. Értesítő,* XLI: 61-73.

MITCHELL R.H., 1989. Aspects of the petrology of kimberlites and lamproites: some definitions and distinctions. *Spec. Publ. Geol. Soc. Aust.*, 14, 7-45.

PEARCE J.A. and CANN J.R., 1973. Tectonic setting of basic volcanic rocks determined using trace element analyses. *Earth Planet. Sci. Lett.*, 19, 290-300.

STRECKEISEN A., 1954. Das Nephelinsyenit-Massiv von Ditro (Siebenbürgen), II. Teil. *Schweiz. Mineral Petr. Mitt.,* 34: 336-409.

STRECKEISEN A. and HUNZIKER J.C., 1974. On the origin of the Nephelinsyenit Massif of Ditró (Transylvania, Romania). *Schweiz. Mineral Petr. Mitt.,* 54: 59-77.

VENDL M., 1926. Telérkőzetek a ditrói nefelinszienit masszívumból. *Mat. term. tud. Értesítő,* XLIII: 215-243.

GILL J. B., 1982. Orogenic Andesites and Plate Tectonics. Springler (Editor), Berlin.

JAKAB Gy., 1998. Geologia masivului alcalin de la Ditrău. Pallas-Akadémia (Editor), Miercurea Ciuc, 298p.

PÁL-MOLNÁR E., 2000. Hornblendites and Diorites of the Ditró Syenite Massif. Department of Mineralogy, Geochemistry and Petrology, University of Szeged (Editor), Szeged, 172p.

ROCK N.M.S., 1987. The nature and origin of lamprophyres: an overview. In: J.G. FITTON and B.G.J. UPTON (Editors), Alkaline Igneous Rocks. Blackwell, Edinburgh, pp.191-226.

Structural and Paleomagnetic Analysis of Miocene Rocks in Northern Transdanubia

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We carried out coordinated paleomagnetic investigation and structural analysis in the northwestern part of the Pannonian basin (northern Transdanubia: Transdanubian Range and Sopron Hills). Our aim was to reconstruct the structural evolution and to establish the temporal and casual connection of rotation(s) and brittle faulting. In addition we used previously published results (Csillag et. al., 2004, Fodor, 1991, 1995, Márton and Fodor, 2003) and reinterpreted some structural ones (Bada el. al., 1996).

We could distinguish three main events of deformation, all of them tensional in character. The first (F1) could have lasted from late early Miocene to late Badenian with NE-SW tension. During the second phase the tension was WNW-ESE (to E-W?) directed (Sarmatian, F2a), and changed to E-W (F2b) in early Pannonian. The third phase, characterized by NW-SE tension started in late Pannonian and was probably active till the Quarternary (Fig. 1.).

The first phase (F1) was observed in the Transdanubian Range only on the pre-Badenian rocks, in the Sopron Hill area on Badenian limestone. The earlier event of the second phase (F2a) was measured on the Sarmatian rocks both the Transdanubian Range and the Sopron Hills. This stress field affected the rocks both in syn-sedimantary and post-sedimentary manners. The third phase was visible on all studied rocks from pre-Badenian to Pannonian age.

Fifteen localities were collected for paleomagnetic analysis from the Transdanubian Range (10 localities) and from the surroundings of the Sopron Hills (5 localities). Most of the localities were freshly excavated, but the grain-size of the sediments was not always ideal. In the Transdanubian Range, Pannonian marls and siltstones were drilled. In the Sopron Hills, we sampled Badenian marl, Karpatian siltstone and underlying Paleozoic gneiss,