According to the observed mineral assemblages and calculated PT conditions, exhumation of the Kutná Hora Crystalline Complex rocks occurred at different PT path comparing to that of the Moldanubian zone in Austria. In the Moldanubian zone, decompressional anatexis resulted in stabilization of LP mineral assemblages with sillimanite and spinel in migmatites and LP overprint of eclogites and HP granulites. In contrast, the Malín and Běstvina migmatites and felsic granulites are characterized by a PT path implying almost isobaric cooling. The presence of kyanite in leucosomes of migmatites suggests that anatexis occurred already during the high-pressure stage. The kyanite-bearing migmatites and HP felsic granulites of the Malín and Běstvina formations may represent well-preserved segment of extensively granulitized lower crust of the Variscan orogenic root, which was not affected by late LP overprint probably due to very high exhumation and cooling rates.

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Geodynamic Significance of Late Cretaceous Lamprophyres from the Carpathian-Pannonian Region

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Late Cretaceous lamprophyres as dyke swarms have been found in two major locations within the Carpathian-Pannonian Region: 1) Villány Mts situated in Tisza megaunit – S Hungary and 2) NE Transdanubia situated in Alcapa megaunit. Previous studies (Szabó et al. 1993, Nédli 2004, Nédli and M. Tóth, submitted) showed that these dyke swarms petrographically and geochemically are similar and their melts probably derived from the same or very similar asthenospheric mantle sources. The lamprophyric melts originated from significant depth in the upper mantle and show no signs of crustal contamination. In this way they carry specific geochemical, petrologic information about the Late Cretaceous lithosphere-asthenosphere beneath the region. Their xenolith content reveals also the physical-chemical characteristics and processes of the pre-Paleogene crust and mantle. Considering that these dykes are situated on two different microplates (Tisza and Alcapa), their study can contribute to the geodynamic evolution of the microplates composing the Carpathian-Pannonian Region.

Dykes studied petrographically are alkali lamprophyres with porphyritic texture containing olivine and clinopyroxene phenocrysts and a fine-grained, pyroxene-rich groundmass. Whole rock K/Ar data for the dykes indicate Late Cretaceous age (Dunkl 1991, Molnár and Szederkényi 1996). Based on the geochemical characteristics, these dykes are thought to have been originated from an enriched (EM II-type) garnet lherzolite mantle source by low degree partial melting. Significant negative Nb-Ta anomaly, extreme LILE and LREE enrichment, moderate enrichment in HFS elements (Fig. 1) and geochemical similarity to other EM-type mantle sources worldwide (Weaver et al. 1986) suggest the subduction-related origin of the enriched component of the source).

Both dykes contain abundant xenocrysts and xenoliths of lower crust or upper mantle origin (Szabó 1985, Kubovics et al. 1989, Molnár and Szederkényi 1996, Nédli and M.Tóth 1999). Xenoliths from Villány Mts. are mainly four phase spinel lherzolites, whereas in Transdanubian lamprophyres occur a large variety of xenoliths (e.g. pyroxenites, lherzolites, websterites, wehrlites). Some samples from both localities contain OH-bearing minerals suggesting that hydrous metasomatism effected the source mantle region of the xenoliths. Both xenolith series reveal a deformed and re-equilibrated subcontinental mantle.

The significant chemical, petrographic, petrogenetic and age similarities of lamprophyres from the Villány Mts. and NE Transdanubia suggest similar or the same mantle source for these igneous activities. Their mantle source region must be of asthenospheric origin, due to the unequivocally different lithospheric composition of the Alcapa and Tisza units, separated by the Mid-Hungarian Zone (e.g. Csontos and Nagymarosy 1998, Kovács et al. 2006). These lamprophyres carry the evidence of the presence of similar or the same subduction-related, enriched asthenospheric subcontinental mantle component beneath the Tisza and Alcapa microplates in the Late-Cretaceous, which were located about 400 km from each other in the Late Cretaceous (Csontos and Vörös 2004).

On reconstructions of Late Cretaceous structural elements in the Alpine-Carpathian-Pannonian area (Csontos and Vörös 2004), it is clear that the localities containing lamprophyre dykes are aligned along the Peri-Adriatic Fault, with the Villány Mts near Beograd, whereas the Transdanubian Region is situated between the Southern and Central Alps. In time and space the closest suspected subductions in the surroundings can be related to the Budva-Pindos or Meliata-Vardar oceans. Extension stresses related to the Budva-Pindos subduction, started in the Mid-Late Cretaceous (Csontos and Vörös 2004), could affected the formation and ascending of the lamprophyric melts in the Tisza sector. However, this subduction seems too late to cause the upper mantle deformation and metasomatism detected in the xenoliths; at least 24 Ma years is necessary for an extensive metasomatism of the mantle wedge (Greya et al. 2002). This process probably could be due to the former closure of the Meliata-Vardar ocean, ended by the Middle Cretaceous (Csontos and Vörös 2004). Even if these subductions could be reasonable candidates for mantle enrichment and deformation in the case of Villány Mts, they can hardly explain the mantle enrichment beneath the Transdanubian region, not being extended west-bound until the Alcapa microplate (Csontos and Vörös 2004). This suggests that, in this case, at least two separated subduction-related enriched mantle domains existed beneath the Alpine-Carpathian-Pannonian area in the Late Mesozoic. Explain the subduction-related deformation and enrichment beneath the Alcapa microplate is even more difficult, the Penninic-ocean seems to be a reliable candidate. However, dating of its opening and closure is uncertain and there have been no direct subduction-related magmatic traces of its subduction detected previously.

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Tertiary Stress Field Evolution in the Eastern Part of the Bükk Mountains, NE Hungary

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The Bükk Mts. consists of Paleozoic and Mezozoic rocks surrounded by Tertiary sediments and volcanics of the Pannonian basin, so it can be regarded as an uplifted and exhumated part of the basement. According to the 43±8 MY cooling ages of Dunkl et al. (1994) (apatite fission track, cooling under 70°C) and the Late Eocene age of the oldest known Tertiary sedimentary rocks (limestone with Nummulites) of the Bükk Mts. the first Tertiary exhumation occurred in the Middle Eocene. After some periods of sedimentation and volcanism the present state is the almost perfect exhumation of the basement rocks with well-defined edges around and with few remnants of the cover inside the mountains. These basement rocks on the steep slopes of