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Position of reference mammal localities of the Lower Villafranchian in the magnetochronological scale

Posice referenčních savčích lokalit spodního Villafranchianu v magnetochorologickém měřítku

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Abstract. The sequence of the mammalian localities of the Lower Villafranchian (LV) is defined by paleomagnetic data together with hypsodonty levels among three phyletic lineages of rhizodont voles: *Mimomys*, *Borsodia*, and *Pitymimomys*. The oldest LV localities (zone MN16a, zone of *Mimomys hajnackensis*) are Triversa and Korotojak 1. They confined to uppermost part of the Gilbert Chron. The upper boundary of the Lower Villafranchian and that of the zone MN16b (zone of *Mimomys polonicus*) is defined by position of the locality Stranzendorf C with *M. praepliocaenicus* in the uppermost part of the Gauss Chron. The boundary of zones *M. hajnackensis* and *M. polonicus* is close to the base of the Kaena Subchron of the Gauss Chron.

INTRODUCTION

As shows the review of recent publications, there is no common opinion on the position of the Lower Villafranchian in the magnetic polarity time scale. This is a result both of different interpretations of paleomagnetic data on some LV localities and also the different concepts on the range of the Lower Villafranchian.

We consider LV (= Lower Villanyian) within the range of zone MN16 as defined by the stratotype localities of Triversa and Arondelli (De Bruijn et al. 1992). Zone MN16 is subdivided into Rodent Zones: *Mimomys hajnackensis* (MN16a) and *Mimomys polonicus* (MN16b) (Fejfar & Heinrich 1989).

Recently *M. hajnackensis* was shown to be a junior synonym of *M. hassiacus* Heller, 1936 (Fejfar et al. 1998). Thus, many paleontologists from Western Europe define the earlier part of Vilanyian by the species *M. hassiacus* (Storch & Fejfar 1990). However specimens of Heller's type collection of *M. hassiacus* from Gundersheim, and additional material from the Gundersheim 4 locality of a similar age (Fejfar & Storch 1990), show considerable differences in anteroconid morphology as compared to most known samples of large *Mimomys* voles of the lineage *M. polonicus-pliocaenicus*. The main differences are a deep insular reentrant both in young and heavily worn specimens of m1 and small rounded enamel island. Besides, the single pictured M3 (Fejfar & Storch 1990: Fig. 110) has a deep LRA3 filled with cement and not reduced by insulation. Other known early

members of *polonicus* group have compact triangular anteroconid of m1 with large, oval, stretched enamel island (AGAJANIAN 1976, van der MEULEN & van KOLFSCHOTEN 1998, MÖRS et al. 1998) and M3 with posterior island formed by insulation of posterior lingual reentrant. But the revised type series of *M. hassiacus* contains one specimen that closely matches typical large *Mimomys* ex gr. *polonicus* (STORCH & FEJFAR1990: Figs 1–2). This molar has also higher dentine tracts comparable to known *M. polonicus*. Therefore, the type series of F. Heller may contain heterogeneous sample that cannot be used for the discussed group of voles of the first part of the Early Villanyian and zone MN16a. Additional revision of the type material of *M. hassiacus* is needed. At the same time, according to the first description of *M. hajnackensis*, this vole has lower dentine tracts than the type *M. polonicus* from Rębielice Królewskie 1. In this situation we favour the usage of *M. hajnackensis* Fejfar, 1961 for the characteristic of the zone MN16a.

MATERIALS AND METHODS

To refine the position of the Lower Villafranchian in the magnetochronological scale we used localities with fossil voles and paleomagnetic data. The stratigraphic sequence of localities is controlled by both geological data and stages of progressing hypsodonty in three phyletic lineages of large *Mimomys*, *Pitymimomys* and *Borsodia*. Hypsodonty, expressed through HH-index, is in direct ratio with time up the chronological scale. We used original data on hypsodonty values of voles from East European localities. Hypsodonty values of Austrian and German localities were taken from the literature.

It is worth noting that HH-index values estimated on a limited number of specimens may not correctly reflect the general mean of a sample.

We follow MN zonation as defined by MEIN (1989). European rodent zone definitions are according to FEJFAR & HEINRICH (1989). Geomagnetic polarity time scale is after CANDE & KENT (1995).

POSITION OF LOCALITIES IN THE MAGNETOCHRONOLOGICAL SCALE

Most reliable position is inferred for localities Stranzendorf C and D (Fig. 1). Stranzendorf C is immediately below the Gauss / Matuyama reversal. Stranzendorf D is right above this boundary (RABEDER 1981). The both sites yielded remains of *Mimomys praepliocaenicus*. This species is a transitional between *M. polonicus* and *M. pliocaenicus*.

The locality Veselovka in the Taman Peninsula is associated with normally magnetized deposits of the Lower Kujalnik and correlated to upper part of the Gauss Chron. According to values of HH-index of *Borsodia*, the locality is slightly older than Stranzendorf D. Remains of large *Mimomys* from this locality are scanty and cannot be used for additional characteristics.

The Akkulaevo locality (the Bashkir Urals area) with *M. polonicus* is associated with the Middle Akchagyl deposits and has no paleomagnetic characteristics. HH-index of *Pitymimomys* places the site below both Stranzendorf D and Veselovka.

The Simbugino locality (the Bashkir Urals area) with *M. polonicus* also lacks clear paleomagnetic data. On the basis of hypsodonty of *Pitymimomys* it is somewhat older than Akkulaevo. A single value of HH-index of *Borsodia* does not contradict this inference.

The Kushkuna locality (Azerbaijan) is confined to normally magnetized deposits of the Middle Akchagyl right above tuff bed with track date 2.88 ± 0.24 (GANZEJ 1987). Hypsodonty of *Mimomys polonicus* from this locality is identical to the type form from Polish locality Rębielice Królewskie 1.

The isolated m1 of *Mimomys polonicus* from Deutsch-Altenburg 21 (RABEDER 1981) is less hypsodont than the sample of Kushkuna. Moreover, HH-index of *Pitymimomys* from this Austrian locality is much lower than in this vole in Simbugino.

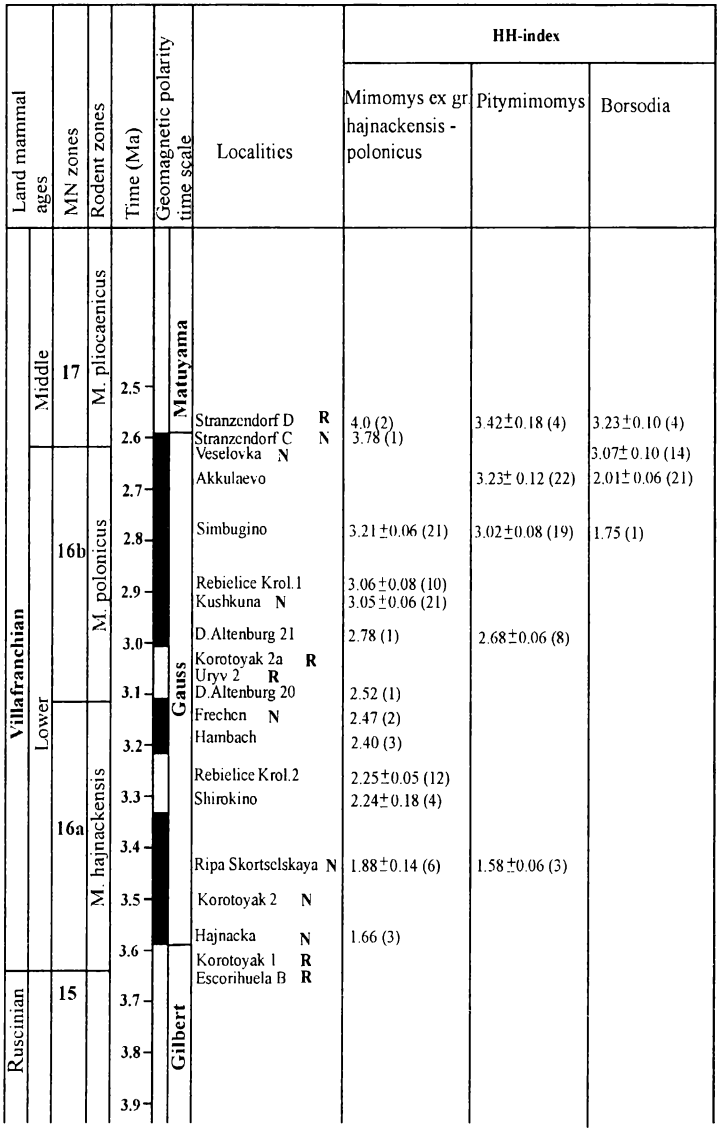

Fig. 1. Position of mammalian localities in the magnetochronologic dcale and HH-index of voles (N – normal polarity, R – reversed polarity).

Localities in the middle flow of the Don River Korotoyak 2a and Uryv 2 with *M. polonicus* are in reversely magnetized deposits (IOSSIFOVA & SEMENOV 1998) that may be correlated to the Kaena Subchron of the Gauss Chron.

There is insufficient information to determine the position of the Deutsch-Altenburg 20 locality in the magnetochronological scale and to place it relative to Korotoyak 2a and Uryv 2 sites. According to RABEDER (1981), this fauna is older than that of Deutsch-Altenburg 21.

Frechen locality (Germany) yielded remains of a large vole described as M. cf. *polonicus* (KOLFSCHOTEN et al. 1998). Another German locality, Hambach produced remains of *M. hassiacus* (= *M. hajnackensis*) (MÖRS et al. 1998). Most probably the both forms represent the same species, *Mimomys hajnackensis*. Both localities are in Reuver clays (Reuverian B, unit 11). In Frechen the deposits are normally magnetized (KOLFSCHOTEN et al. 1998). Normal magnetization is also known for the main series of Reuver clays (unit 11) in the Fortuna mine. Only the uppermost part of this unit is reversely polarized (BOENIGK et al. 1979). This paleomagnetic characteristics of the Reuver clays together with presence of *M. hajnackensis* (Frechen and Hambach) enable to place these localities stratigraphically below Korotoyak 2a and Uryv 2 sites with *M. polonicus*. Two German localities may be correlated to a normal Subchron between the Mammoth and Kaena Subchrons of the Gauss Chron.

We place Rębielice Królewskie 2 and Shirokino below the just mentioned localities on the basis of lower HH-index values of *M. hajnackensis*. Still lower hypsodonty of *M.* ex gr. *hajnackensis* is known in the locality Ripa Skortselskaya (Moldova). This locality is associated with normally magnetized deposits referred to a lower part of the Gauss Chron.

Normally magnetized deposits in the Korotoyak 2 (Middle Don area) locality contain remains of *M. hajnackensis* that is morphologically similar to the type form of Hajnáčka, Slovakia (AGADŽANJAN & GLUŠANKOVA 1988). Hajnáčka is correlated to the base of the Gauss Chron (LINDSAY et al. 1997).

Remains of a vole that is more primitive than the type *M. hajnackensis* is known in reversely magnetized deposits of the Korotoyak 1 locality (AGADŽANJAN & GLUŠANKOVA 1988, IOSSIFOVA & SEMENOV 1998). We refer this site to the upper part of the Gilbert Chron.

DISCUSSION

Mimomys praepliocaenicus can be considered as an independent species, or be included into *M. pliocaenicus* s. l. In both approaches the upper boundary of the Lower Villafranchaian, i.e. upper limit of *M. polonicus* zone (zone MN16b), is drawn within the uppermost part of the Gauss Chron. Stranzendorf C locality with *M. praepliocaenicus* is dated to the uppermost part of the Gauss Chron.

AZAROLLI (1977) considered faunas of Montopoli and Triversa among Lower Villafrancian associations. Montopoli locality with large mammal fauna is confined to the base of the Matuyama Chron. However De GIULI et al. (1983: 324) noted that «..According to several authors, the Triversa and Montopoli Units make up the Lower Villafranchian «Mammal Age». However, because of their strong faunal change, faunal change clearly detectable at least in all Eurasia, it is advisable not to group these two Units into the same super-unit». By the presence of *Equus* and *Archidiskodon* we think it possible to assign the Montopoli fauna to earliest Middle Villafranchian faunas.

The lower boundary of *M. polonicus* zone (MN16b) is close to the base of the Kaena Subchron. The position of the boundary is defined by localities Frechen and Hambach with *M. hajnackensis* in normally magnetized deposits referable to mid-Gauss normal magnetozone between Kaena and Mammoth Subchrons. Additional control is presented by Korotoyak 2a and Uryv 2 sites correlated to the Kaena Subchron.

Close hypsodonty levels of *M. polonicus* from the type locality Rębielice Królewskie and the fauna of Kushkuna enable to consider them as synchronous. Therefore, the radiometric date from Kushkuna makes it possible to estimate an age of Rębielice Królewskie 1 at about 2.9 Ma.

Till recently the Reuverian B was unanimously correlated to the second half of the Gauss Chron (Zagwijn 1998). However, the above discussed date evidence that the upper boundary of this unit is not younger than the base of the Kaena Subchron. Paleomagnetic characteristics of the Fortuna section that substantiated correlation of the Reuverian B to the upper part of the Gauss Chron does not contradict this inference.

The lower boundary of the Lower Villafranchian (zone *M. hajnackensis*, zone MN16a) is situated somewhat below the Gilbert/Gauss inversion. This is evidenced by reverse magnetization in the section of Korotoyak 1 with *M. hajnackensis* (more primitive compared with the type form of Hajnáčka), and in the Triversa section (Fornace RDB), the stratotype section of the Lower Villafranchian and zone MN16. Lindsay et al. (1997) place the latter locality into upper part of the Gilbert Chron. Thus, the lower boundary of the Villafranchian should be drawn in the uppermost part of the Gilbert Chron. From below the limit is controlled by the Ruscinian locality Escorihuela B (MN15) that is also correlated to the upper part of Gilbert (Opdyke et al. 1997).

CONCLUSIONS

The following conclusions are based on joint analysis of magnetochronological position of mammal localities and evolutionary levels of large *Mimomys*, *Borsodia*, and *Pitymimomys*.

1. The lower boundary of the Villafranchian is situated in the uppermost part of the Gilbert Chron.
2. The boundary between Rodent Zones *M. hajnackensis* (MN16a) and *M. polonicus* (MN16b) is almost coincident with the base of the Kaena Subchron of Gauss Chron.
3. The upper boundary of the Lower Villafranchian and zone MN16b (*M. polonicus*) is situated in the uppermost part of the Gauss Chron.
4. The upper boundary of the Reuverian is not younger than the mid-Gauss Chron. The Reuverian B (Unit 11) correlates to normal magnetozone between Mammoth and Kaena Subchrons.

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SOUHRN

Sled savčích lokalit spodního Villafranchianu (LV) je korelován s paleomagnetickými údaji a úrovní hypsodontie ve třech fyletických liniích rhizodontních hrabošů rodů *Mimomys*, *Borsodia* a *Pitymimomys*. Nejstarší LV lokality (biozóna MN16a, zóna druhu *Mimomys hajnackensis*) jsou Triversa a

Korotojak 1. Vymezují nejvyšší vrstvu epochy Gilbert. Svrchní hranice spodního Villafranchia a tak i biozóny MN16b (zóna druhu *Mimomys polonicus*) je vymezena posicí lokality Stranzendorf C s druhem *M. praepliocenicus* v nejvyšším horisontu epochy Gauss. Hranice zóny druhů *M. hajnackensis* a *M. polonicus* je blízká basi vrstvy Kaena Subchron epochy Gauss.

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