The early Vallesian vertebrates of Atzelsdorf  
(Late Miocene, Austria). 10. Carnivora

By Doris NAGEL

(With 1 figure and 4 tables)

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This article is dedicated to my dear colleague Dr. Ortwin SCHULTZ.

Abstract

In Atzelsdorf (MN9, Upper Miocene) eleven fossil specimens of carnivores have been found. Although the sample is rather small, three different genera could be identified, among them the first record of Sansanosmilus vallesiensis in Austria. Plesiogulo and Semigenetta were only determined to the genus level because of the low number of specimens.

Keywords: Sansanosmilus, Semigenetta, Plesiogulo, Mustelidae, Hyaeinidae, MN9, Vallesium, Upper Miocene, Lower Austria.

Zusammenfassung


Schlüsselwörter: Sansanosmilus, Semigenetta, Plesiogulo, Mustelidae, Hyaeinidae, Vallesium, MN9, Obermiozän, Niederösterreich.

Introduction

Atzelsdorf (Lower Austria) is about 35 km NW of Vienna (Lower Austria). Geologically, it is situated at the north-western margin of the Vienna Basin and belongs to the Hollabrunn-Mistelbach Formation. The sediments are interpreted as delta deposits of the palaeo-Danube, which filled material into the Pannonian lake during the Late Miocene. Based on biostratigraphical investigations (see HARBHAUSER 2009, this volume) the fauna from the gravel pit in Atzelsdorf belongs to the Vienna Basin Pannonian Zone C, basal MN9 (absolute age approximately 11.2-11.1 Ma) (see HARBHAUSER 2009, this volume).

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Most of the carnivores were found by the private collectors Gerald PEnz (Vienna) and Peter SCHEBECZEK (Pellendorf). Only recently Dr. Gudrun DAXNER-HÖCK, Natural History Museum of Vienna, Department of Palaeontology, undertook a scientific excavation to locate the exact layers bearing mammalian fossils. Casts of the material from the collectors are stored at the Natural History Museum Vienna, Geological-Palaeontological Department.

Methods

Lower teeth are referred to by small letters, as in “m1”, uppers by capitals, as in “P4”, lower canines as Cinf. and upper canines as Csup. Measurements were taken with a caliper to the closest 0.1 mm. Description of tooth morphology follows THENIUS (1989). 

Abbreviations

NHMW – Natural History Museum Vienna

Systematic Part

Order Carnivora BOWDICH, 1821

Family Barbourofelidae SCHULTZ, SCHULTZ & MARTIN, 1970

(sensu MORLO, PEIGNÉ & NAGEL, 2004)

Genus Sansanosmilus KRETZOI, 1929

The genus *Sansanosmilus* is known in Europe from the Middle to the Upper Miocene (later MN5 to MN9) and consists of four species. *S. palmidens* (GINSBURG, 1961) is found from late MN5 to MN6, *S. jordani* (FILHOL, 1883) is known in the Asteracian (from MN6 to MN7-8). BEAUMONT & CRUSAFONT-PAIRÓ (1982) regarded *S. vallesiensis* (MN9) as a species rather than a subspecies of *S. jordani*. *Sansanosmilus piveteaui* (GERAADS & GÜLEÇ, 1997) is recorded from MN9 from Anatolia. The genus may be paraphyletic and *S. vallesiensis* as well as *S. piveteaui* are probably a European parallel evolution to the American *Barbourofelis* (FILHOL 1883; VILLALTA & CRUSAFONT 1943; GINSBURG 1961; HEIZMANN 1973; MORLO 2006).

The oldest Barbourofelids are currently found in Africa. Therefore it is assumed that *Sansanosmilus* migrated from Africa to Europe in MN4, where it co-existed with *Pro-sansanosmilus* in Europe (MORLO et al. 2004).

*Sansanosmilus vallesiensis* BEAUMONT & CRUSAFONT 1982

(figs 1.1a-d)

**Holotype:** right mandible with m1 and alveoli of p4-p3 and of the incisors.

**Type locality:** Santiga, Spain.
Material: NHMW 2008z0059/0001: lower left mandibular fragment with flange, p4 (length x width: 17.9 x 7.6 mm) and m1 (length x width: ca 23.5 x 9.4 mm) distal part broken; NHMW 2008z0059/0002: fragment of lower right canine; NHMW 2008z0059/0003: atlas, NHMW 2008z0059/0004: fragment of caudal vertebra (length of the centrum = 38.9 mm).

Description: The mandible consists of two parts: the distal part of the flange and a mandible fragment with the alveolus of p3, p4 and m1. The latter is broken after the lower carnassial (figs 1.1a–c). The mandible has a strong inflexion only known in the most apomorphic species of the genus Sansanosmilus.

The lower jaw is robust. The foramina mandibulae are placed under the postcanine diastema. The teeth are very worn and no serration can be seen any more. The p3 is missing and only the broken alveolus is still present. One small opening in the alveolus seems to have been the former foramina for the blood vessel and nerve, suggesting a major root. The preservation of the alveolus is rather poor and therefore a small second root, very close to the main one cannot be excluded. The p4 and m1 are strongly rotated backwards. The p4 consists of four cuspid, the main cusp is about one third larger than the anterior one. It is worn, and the posterior cuspid form a small cutting blade at the end of the p4. The two accessory cuspid on p4 are still separated from the main cusp. The paraconid blade of m1 is 10.6 mm in length but it is partly broken and it was approximately about 13.5 mm long. A notch separates the two cusps. Since the protoconid is broken it is not possible to discern if a metaconid or talonid was present. The mandible below m1 measures 30.6 mm and the smallest flange depth is 31.2 mm.

The atlas is of similar size to a recent lion. The articulation facets for the axis are rounded but more closed than in the canids or hyaenids and shallower than in the recent large cats. The transverse processes are broken. The caudal vertebra consists of a compact centrum with no transverse process (fig. 1.1d). Due to its size and the location of discovery, it is tentatively assigned to the Sansanosmilus from Atzelsdorf.

Sansanosmilus vallesiensis differs from S. palmidens and S. jourdani by a larger size, the larger protoconid of m1 in comparison to the paraconid and the larger p4. In S. jourdani the protoconid blade becomes longer. This trend continues in S. vallesiensis and S. riveteai, the latter has almost no notch between the protoconid and paraconid, while the m1 from Atzeldorff still carries a notch. The flange is not fully preserved, therefore its length is not measurable.

Geraads & Güleç (1997) calculated the index p4/m1 for Sansanosmilus: the index is > 0.85 for S. sansaniensis and < 0.72 for S. jourdani. The p4/m1 index for the Atzelsdorf lower jaw is 0.75, between the values given above. The material from Atzelsdorf falls into the size variation of S. vallesiensis, and is approximately 10 % larger than S. palmidens and S. jourdani (tab. 1). The Atzelsdorf material is apomorphic compared to S. jourdani with a longer protoconid on m1 but not as evolved as S. riveteai (Ozansoy, 1965). The latter has a reduced notch on m1 and higher cuspid on p4, which are closer together than in the specimen from Atzelsdorf. The size, the apomorphic m1 and the strongly backwards-rotated teeth are typical for S. vallesiensis. The larger p3, although only judged by the alveolus and the p4/m1 index, indicate a primitive form of S. vallesiensis, less evolved than that from Santiga.
Sansanosmilus vallesiensis is known from MN9 from Spain, Ukraine and now from Austria. This genus is the last member of the Barbourofelidae, which migrated from Africa to Europe in MN4 with Prosansanosmilus (MORLO et al. 2004).

Family Viverridae GRAY, 1821
Genus Semigenetta HELBING, 1927

The genus Semigenetta is very similar to the recent Genetta but it is characterized by apomorphic features such as the complete reduction of the M2 and the strong reduction of the m2. At least two different lineages can be distinguished through time (HEIZMANN 1973; GINSBURG 1999; NAGEL 2003).

Semigenetta sp.
(figs 1.4a-b)

Material: NHMW 2008z0071/0001, left P4 (length x width: 10.1 x 4.9 mm).

Description: The upper carnassial bears a cutting metacone blade approximately the same length as the paracone. A cingulum is well visible on the lingual side and also on the buccal side of the metacone, a tiny parastyle and a reduced paracone. A cingulum is well visible (figs 1.4a-b).

On P4 from Atzelsdorf, the paracone is higher than the metacone blade and the parastyle is quite small, as typical for Semigenetta. The P4 is larger than that of Semigenetta laugnacensis (BONIS, 1973) and S. elegans DEHM, 1950 but slightly smaller than the material from La Grive (MN 7/8). It is comparable to the average size of S. sansanienis (LARTET, 1851) from Steinheim (MN7/8, HEIZMANN 1973), the latest occurrence of this

Tab. 1. Sansanosmilus vallesiensis from Atzelsdorf compared. * from depiction. ° roots. All measurements in mm.

<table>
<thead>
<tr>
<th></th>
<th>p4</th>
<th>m1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>length</td>
<td>width</td>
</tr>
<tr>
<td>S. vallesiensis, NHMW 2008z0059/0001, Atzelsdorf</td>
<td>17.9</td>
<td>7.6</td>
</tr>
<tr>
<td>S. piveteaui, 06-AKM-0276, Sinap, GERAADS &amp; GÜLEÇ 1997</td>
<td>17.7</td>
<td>7.2</td>
</tr>
<tr>
<td>S. palmidens, 454, Sansan, GINSBURG 1961*</td>
<td>15.0</td>
<td>-</td>
</tr>
<tr>
<td>460, Sansan, GINSBURG 1961*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>459, Sansan, GINSBURG 1961*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>456, Sansan, GINSBURG 1961*</td>
<td>16.2</td>
<td>5.8</td>
</tr>
<tr>
<td>S. vallesiensis, Santiga, BEAUMONT &amp; CRUSAFO-N-PAIRÓ 1982</td>
<td>16.6</td>
<td>5.9</td>
</tr>
<tr>
<td>S. jourdani, La Grive-St. Alban, FILHOL 1883*</td>
<td>17.2</td>
<td>-</td>
</tr>
<tr>
<td>S. jourdani, BSP 1951 I 42, Massenhausen°, MORLO 2006</td>
<td>13.7</td>
<td>7.4</td>
</tr>
</tbody>
</table>
Fig. 1. Carnivora from the Late Miocene (Early Vallesian, MN9) of Atzelsdorf (Lower Austria). 1a-d: Sansanosmilus vallesiensis (NHMW 2008z0059/0001), a-c: left lower mandible with p4 and m1; d: atlas (NHMW 2008z0059/0004). 2a-c: Hyaenidae indet. (NHMW 2008z0073/0001), right P3. 3a-c: Plesiogulo sp. (NHMW 2008z0072/0001), upper right P4. 4a-b: Semigenetta sp. (NHMW 2008z0071/0001), left P4. 5a-b: Mustelidae indet. aff. Martes sp. (NHMW 2008z0072/0004: right mandible fragment with p4. a: buccal view, b: lingual view, c: occlusal view. Scale bars equals 5 mm.
species so far (tab. 2). The posterior buccal alveolus of M1 is placed strongly more lingually than the anterior one, indicating a slender tooth, more slender than e.g. known from Plioviverrops.

Atzelsdorf is dated into the lower Vallesian (MN9). Semigenetta is known in MN9 by two taxa. One is from Can Llobateres (MN9, Spain), S. ripolli PETTER (1976), and the other one is S. grandis (CRUSAFONT & GOlPE 1981) from Castell de Barberà (MN9, Spain). Semigenetta ripolli is even smaller than S. laugnacensis and S. grandis is, as the name indicates, is the largest known Semigenetta so far. Both are only known by lower dentition but are far out of the size range of the Atzelsdorf specimen. Maybe Semigenetta sansaniensis persisted in Vallesian (MN9) or the size range of S. grandis is overlapping with S. sansaniensis.

Family Mustelidae FISCHER, 1817
Genus Plesiogulo ZDANSKY, 1924

The genus was erected by ZDANSKY (1924) on Gulo-like material from China. Differences mainly seen in M1 and m1 lead to the split from Gulo on the genus level. While ZDANSKY discussed these differences seen in Plesiogulo as apomorphic, DUBOIS & STEHLIN (1933) regarded them as plesiomorphic and considered Plesiogulo as ancestral to Gulo. A later work on Plesiogulo crassa by KROTKEVICh & SEMENOV (1975) ruled out this possibility again. They argued for a different chewing specialisation which makes an ancestry of Gulo impossible. Plesiogulo is known from MN9 of Hritsev/Gritsev, Ukraine (KOROTKEVICh & SEMENOV 1975) to MN13 in Las Casiones, Spain (ALCALÁ et al. 1994).

During the Upper Miocene, a second Gulo-like form was present: Eomellivora (MN9 to MN12). This musteline mustelid is characterized by a combination of features (see ZDANSKY 1924 and WOLSAN & SEMENOV 1996 for details), e.g. its very large size and the auditory bulla built relatively small. The upper teeth, premolars and molar, are sur-

Tab. 2. Semigenetta from Atzelsdorf compared to different Semigenetta species. S. ripolli and S. grande are only known from lower dentition. () = measured at the alveoli. * measurement from the depiction. All measurements in mm.

<table>
<thead>
<tr>
<th>Species</th>
<th>P4 length x width</th>
<th>M1 length x width</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Semigenetta spp. Atzelsdorf</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. laugnacensis Lg 285, Laugnac, BONIS de, 1994</td>
<td>10.1 x 4.9</td>
<td>3.5 x 6.4</td>
</tr>
<tr>
<td>S. elegans 13 37, Winterhof-West, DEHM 1950</td>
<td>8.0 x 4.4</td>
<td>3.2 x 6.2</td>
</tr>
<tr>
<td>S. sansaniensis Vieux-Cologne; VIRET 1958</td>
<td>8.7 x 4.8</td>
<td>3.7 x 7.3</td>
</tr>
<tr>
<td>S. sansaniensis GRU-B1-1, Grund, NAGEL 2003</td>
<td>9.7 x 6.0</td>
<td>3.8 x 7.4 to 5.0 x 9.6</td>
</tr>
<tr>
<td>S. sansaniensis 814, Sansan, GINSBURG 1961</td>
<td>10.3 x 5.5</td>
<td></td>
</tr>
<tr>
<td>S. sansaniensis 1307, La Grive, VIRET 1951*</td>
<td>10.6 x 5.6</td>
<td>5.2 x 7.4*</td>
</tr>
<tr>
<td>S. steinheimensis, Stuttgart, HEIZMANN 1973</td>
<td>10.8 x 6.3</td>
<td>5.1 x 7.4</td>
</tr>
<tr>
<td>S. steinheimensis, Stuttgart, HEIZMANN 1973</td>
<td>10.1 x 5.5</td>
<td>4.7 x 8.6</td>
</tr>
</tbody>
</table>
rounded by a prominent cingulum and on P4 an bulging buccal base is visible. The protocone of P4 is well-separated from the main cusp. The m1 lacks the metacone or it has a vestigial one. *Plesiogulo* is smaller in size, the upper teeth, premolars and molar, are surrounded by prominent cingulum on the buccal side, rarely on the lingual one. The protocone on P4 is weakly separated from the paracone. The metacone is smaller than the paracone on M1 but still present. The teeth have rugose enamel (ZDANSKY 1924; KURTÉN 1970). Although the specimen from Atzelsdorf is partly broken, its size, the rugose enamel and the well-developed buccal cingulum allow its attribution to the genus *Plesiogulo*.

**Plesiogulo sp.**

(figs 1.3a-c)

**Material:** NHMW 2008z0072/0001: upper right P4 (length x width of the paracone blade: 19.7 x 8.5 mm); NHMW 2008z0072/0003: left Cinf.; NHMW 2008z0072/0002: fragment of axis.

**Description:** On the P4, the paracone is higher than the metacone. The protocone is missing. There is a small buccal cingulum. The enamel shows a slightly rugose structure on the buccal side and some small folds are visible on the lingual-posterior part. The roots are broken and were not fully developed. This and the fact that no wear facets can be seen lead to the assumption that the P4 was from a young and not fully grown individual (figs 1.3a-c).

Five species of *Plesiogulo* are accepted in the Eurasian record: *P. brachygnathus* ZDANSKY, 1924, *P. minor* TEILHARD & LEROY, 1945, *P. crassa* TEILHARD & LEROY, 1945, *P. praecocidens* KURTÉN, 1970 and *P. monspessulans* VIRET, 1939. *Plesiogulo major* was described by TEILHARD & LEROY, 1945. HENDEY (1978) first proposed the possibility that *P. major* is a synonym of *P. monspessulans* and ALCALÁ et al. (1994) as well as HAILE-SELASSIE (2004) supported this. Furthermore, *Plesiogulo* is known from North America with *P. marshalli* and *P. lindsayi* (HARRISON 1981) as well as from Africa with *P. botori* (HAILE-SELASSIE et al., 2004) and maybe with *P. praecocidens* (MORALES et al. 2004).

*Plesiogulo monspessulans* is a large form of *Plesiogulo*, the cusps on M1-trigon are smaller, although the tooth in general is larger than all other known ones and the metaconid on m1 is still present. *Plesiogulo crassa* has stocky premolars and a P4 with the same length/width ratio as *P. botori* and *P. marshalli*. *P. praecocidens* is smaller than *P. crassa*, the metaconid is absent on m1 and the M1 has completely different proportions (KURTÉN 1970). *Plesiogulo brachgnathus* is the smallest known form (KOUFOS 1982).

The P4 from Atzelsdorf fits in size (tab. 3) and morphology within the range of *P. crassa*, but since no M1 is known from Atzelsdorf to allow a more detailed investigation, the P4 is assigned to *Plesiogulo* sp. For further size comparison of the different *Plesiogulo* species see KOUFOS (2006).

*Plesiogulo* is known from Europe (KOUFOS 1982; KOROTKEVICH & SEMENOV 1974), Asia (ZDANSKY 1924; VIRET 1939; TEILHARD & LEROY 1945; KURTÉN 1970), Afrika (HAILE-SELASSIE et al. 2004) from MN 9 to MN 13 and from North America where the
immigration of this animal is one criteria of determining the Late Hemiphillian (HARRISON 1981).

Mustelidae indet. aff. Martes
(figs 1.5a-b)

Material: Colln PENZ No. 53: left mandible fragment with distal root fragment of m1 and alveoli of m2. NHMW 2008z0072/0004: right mandibular fragment with p4 (length x width x height: 9.1 x 4.1 x 5.2 mm).

Description: The p4 bears a tiny anterior accessory cuspid and a posterior cusp closely attached to the main cusp. The tip of the latter is broken. A weak cingulum surrounds the tooth on the buccal side only rising a little bit at the posterior end, there forming a small cuspid (figs 1.5a-b). The tiny anterior cusp and the larger size of the tooth distinguish it from the Viverridae and Herpestidae, which are smaller and/or have a larger anterior cusp. The size and especially the height of the tooth, compared to its length exclude Melinae, Mephitinae, Gulolinae and Lutrinae. Within the Mustelinae, the specimen is closest to the Martes-group (KOUFOS 2006; PETTER 1976; GINSBURG 1961).

Mustelidae indet.


Description: canine of medium size, slender and slightly curved. The assignment to the mustelids was made due to size and form of the canine.

Tab. 3. Plesiogulo sp. from Atzelsdorf compared to different Plesiogulo species. All measurements in mm.

<table>
<thead>
<tr>
<th>Plesiogulo sp. Atzelsdorf</th>
<th>P4 length</th>
<th>P4 width</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. minor, K'ingyang, KURTÉN 1970</td>
<td>17.0</td>
<td>10.5</td>
</tr>
<tr>
<td>P. praecocidens, Loc.49, China, KURTÉN 1979</td>
<td>17.2</td>
<td>10.9</td>
</tr>
<tr>
<td>P. brachygнатhus ZDANSKY 1924, Loc.49, Ex.5</td>
<td>17.1</td>
<td>11.1</td>
</tr>
<tr>
<td>P. crassa China Loc.49, KURTÉN 1970</td>
<td>20.5</td>
<td>14.0</td>
</tr>
<tr>
<td>P. crassa Yushe, KURTÉN 1970</td>
<td>18.5</td>
<td>13.8</td>
</tr>
<tr>
<td>P. crassa, Cherevichnnoe, KOROTKEVICH &amp; SEMENOV 1974</td>
<td>17.0 - 18.0</td>
<td>-</td>
</tr>
<tr>
<td>P. monspessulanus, Teruel Basin, ALCALÁ 1994</td>
<td>23.2</td>
<td>15.6</td>
</tr>
<tr>
<td>P. botorí, Narol, Africa, HAILE-SELASSIE et al. 2004</td>
<td>24.2</td>
<td>16.7</td>
</tr>
<tr>
<td>P. marshalli, North America, HARRISON 1981</td>
<td>18.5 - 21.7</td>
<td>12.1 - 15.0</td>
</tr>
<tr>
<td>P. lindsayi, North America, HARRISON 1981</td>
<td>23.5</td>
<td>17.3</td>
</tr>
</tbody>
</table>
Family Hyaenidae Gray, 1821

Hyaenidae indet.
(figs 1.2a-c)

Material: NHMW 2008z0073/0001: right P3 (length x width: 15.8 x 11 mm).

Description: Only the crown of P3 is preserved, the roots are missing. A strong cingulum surrounds the tooth. On the anterior side, a small cuspid is visible sitting on the broad cingular projection of the tooth, together with several cingular folds. Posterior, a strong cusp is developed. The cingulum surrounds the whole tooth, which has a convex shape in the lingual posterior part (figs 1.2a-c).

The tooth is larger than known from Plioviverrops Kretzoi, 1938 or Protictitherium Kretzoi, 1938 but smaller than Adcrocuta (Roth & Wagner 1854). Despite recent works, there is still no consensus about the medium-sized hyaenids in the Upper Miocene. Turner et al. (2008) accept Ictitherium Wagner 1848, Thalassictis Gervais, 1850 ex Nordmann, Hyaenictherium Kretzoi, 1938, all with a canid-like dentition (Ecomorph Group 3), and Lycaena Hensel, 1863, Hyaenictis Gaudy, 1861 and Chasmaphorthes Hay, 1921. These three have a bone-cracking tendency (Ecomorph Group 4). Semenov (2008) additionally lists Miohyaenotherium Semenov, 1989 and Hyaenotherium Semenov, 1989 and together with Hyaenictherium he attributes them to the subfamily Hyaenotherini, while in his opinion the subfamily Ictitherini consists of Ictitherium and Thalassictis. Miohyaenotherium is also mentioned in Tseng & Wang (2007) for Western Eurasia.

Other Upper Miocene hyaenids are: Metahaena Viranta & Werdelin, 2003, known from a single mandibular ramus found in the Sinap Formation (Locality 12, MN9), Belbus Werdelin & Solounias, 1991, the Asian Palinhaena Qiu et al., 1979 and Leecyaena Young & Liu, 1948 (= ?Pliocrocuta after Turner et al. 2008) as well as the African Ikelohyaena Werdelin & Solounias, 1991. They are referred to as transitional bone-cracking hyaenids (Turner et al. 2008).

The genera Ictitherium, Hyaenictherium and Thalassictis all have slender P3 (see tab. 3), Lycaena, Metahaena, Belbus and Ikelohyaena are only known from lower dentition. The latter is comparable in size to Hyaenictherium (Werdelin 2004). Palinhaena has not been reported in Europe and the ecological niche was probably taken by Bel-

Tab. 4. Hyaenidae indet. from Atzelsdorf compared to the common genera from Europe in the Upper Miocene. All measurements in mm.

<table>
<thead>
<tr>
<th></th>
<th>lenght</th>
<th>width</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyaenidae indet., Atzelsdorf</td>
<td>15.8</td>
<td>11</td>
</tr>
<tr>
<td>Thalassictis robusta, Dom-Dürkheim 1, MORLO 1997</td>
<td>11.6</td>
<td>7.0</td>
</tr>
<tr>
<td>Thalassictis robusta, Kishinev, SEMENOV 1989</td>
<td>12.2</td>
<td>6.2</td>
</tr>
<tr>
<td>Hyaenictherium wongi, Greece, KOUFOS 2000</td>
<td>15.5 - 17.7</td>
<td>8.4 - 10.0</td>
</tr>
<tr>
<td>Ictitherium viverrinum, Greece, WERDELIN, 1988; KOUFOS 2000</td>
<td>14.0 - 15.5</td>
<td>6.7 - 7.9</td>
</tr>
</tbody>
</table>
bus (Werdein & Solounias 1991). *Lycaena* is a larger form, probably larger than the specimen from Atzelsdorf (Bonis et al. 2008).

As presented above, this single specimen from Atzelsdorf cannot be compared with all genera known so far from the Upper Miocene of Europe. Therefore the author refers it to Hyaenidae indet.

**Carnivora indet.**

**Material:** NHMW 2008z0074/0000: large third phalange; NHMW 2008z0074/0000: proximal fragment of axis, dent is broad and flat; ATZ S145: first phalange, about the size of a large mustelid; NHMW 2008z0074/0000: fragment of the distal metapodial joint; NHMW 2008z0074/0000: lumbar vertebra

**Remarks:** This postcranial material is placed into Carnivora indet. because of the general morphology of the specimens but no further determination is possible.

**Conclusion**

Although only few carnivore remains were discovered in Atzelsdorf, an interesting variety of different taxa was found. Unfortunately, the poor and fragmentary material does not allow a specific determination of several taxa, like *Semigenetta* and *Plesiogulo* which can only be identified to the genus level. However, *Sansanosmilus vallesiensis* is reported for the first time from Austria and *Plesiogulo* cf. *crassa* from MN9 has been known only from Eastern Europe and Asian localities and now for the first time from Central Europe.

**Acknowledgements**

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