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### Short Communication

## New Miocene record of the suid *Listriodon* near Munich

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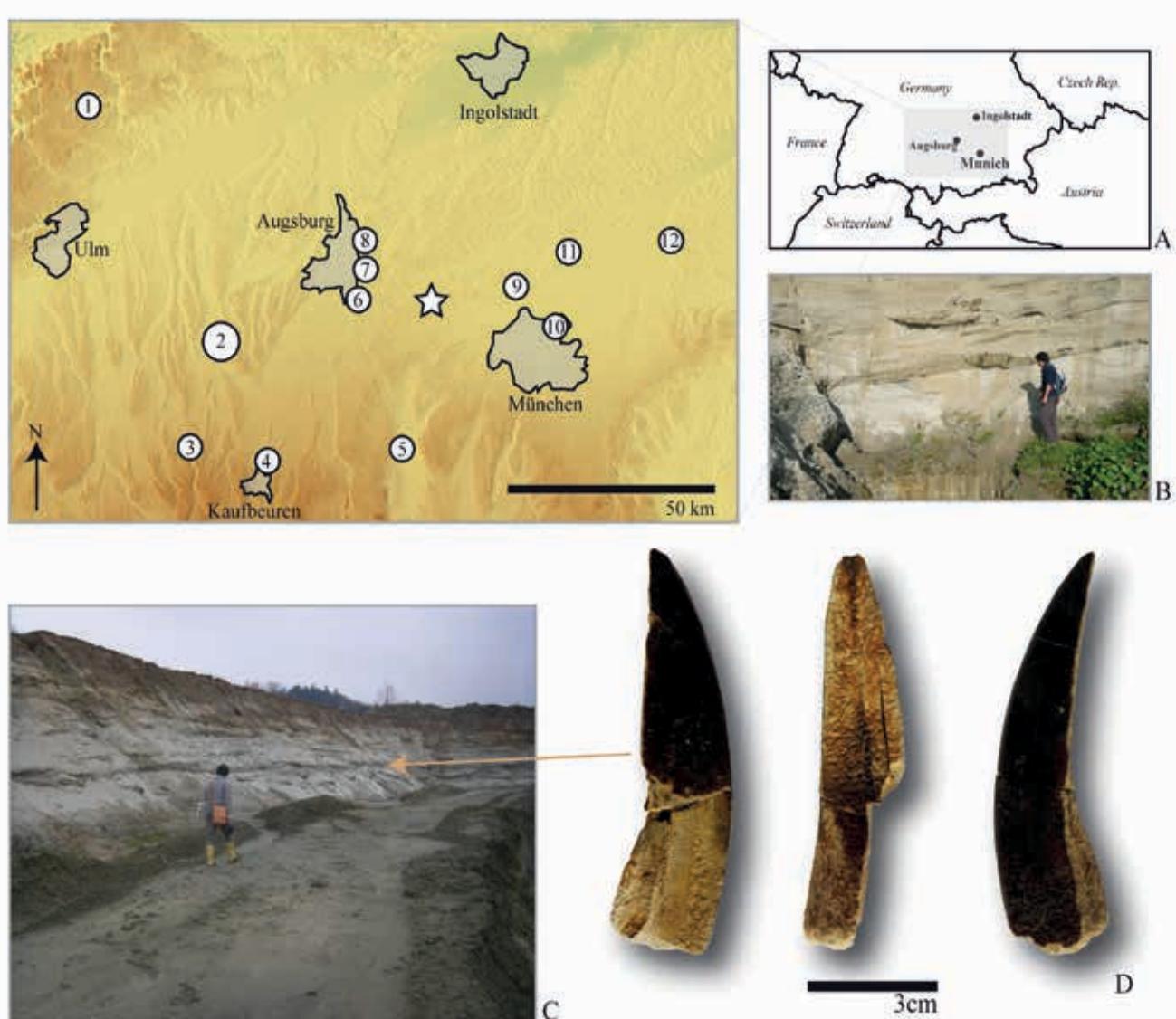
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Listriodontine pigs are characterized, among other morphological traits, by their highly enlarged incisors, strong sexual dimorphism in the canines, as well as the tendency to develop lophodont molars, remembering thus in some points those of tapirs (Van der Made 1996; see also Orliac 2006 and Pickford & Morales 2003). In particular, the species *Listriodon splendens* has an historical status. It has been defined as early as the middle of the 19<sup>th</sup> century based on fossils from the Swiss part of the North Alpine Foreland Basin (NAFB) (von Meyer 1846). In Germany, the suid found soon the interest of scholars, especially the very well-preserved lower jaws from Markt Rettenbach (Stromer 1930; Dehm 1934).

*Listriodon splendens* is also an important taxon for biostratigraphic purposes (e.g., De Brujin et al. 1992; Mein 1999; Agusti et al. 2001). The transition from the biostratigraphic mammal zones MN5 to MN6 traditionally coincides with the disappearance of *Bunolistriodon* and the appearance of truly lophodont *Listriodon* (Mein 1999). Paradoxically, when Heißig (1997: 541) proposed a biostratigraphic scale for the German part of the NAFB (MN4 to MN6), he commented on the fully absence of *Listriodon* or *Bunolistriodon* before MN 8 (ca. 13.8 Ma after Kälin & Kempf 2009) in this area. This is in accordance with the observations made by Kälin & Kempf (2009) who correlated the first occurrence of *Listriodon* in Switzerland during the short MN7 (ca. 13.8–13.9 Ma after Kälin & Kempf 2009). Indeed, these discrepancies might derive from problems in the use of the MN zonation on a European scale that are beyond the scope of this short contribution (e.g., Van der Meulen et al. 2012).

Forms related to *Bunolistriodon lockharti/latidens* were documented from the base of the Upper Freshwater Molasse (lower Miocene) (e.g., Dehm 1934; Van der Made 1996; Eronen & Rößner 2007; Sach 2014). According to Böhme et al. (2012), *Listriodon splendens* first occurs in Central Europe at around 14.2 Ma in Klein-Hadersdorf (Austria). Seehuber (2009) considered the finds from Stätzling (Germany) as probably older than 14.4 Ma because they derived from sediments deposited under the post-Riesian bentonite (see Abdul-Aziz et al. 2010 for chronostratigraphic framework). A direct ancestor/descendant relationship between *Bunolistriodon lockharti* and *Listriodon splendens* is generally excluded (Van der Made 1996; Orliac 2009; Orliac et al. 2009; versus Pickford & Morales 2003), and the younger species is viewed as a migrant to the NAFB of Asiatic origin.

While the Miocene mammal record from Southern Germany is now seen such as one of the richest in Europe, findings of *Listriodon splendens* remain relatively rare (Fig. 1A), most probably because of the lack of deposits covering the stratigraphic range of the species. In this context, the discovery of a *Listriodon* tooth in a sand/clay pit 1 km east of Oberweikertshofen near Fürstenfeldbruck (Bavaria) deserves some attention. This fossil comes from a sandy layer that is interpreted as a channel filling cut into several meters of marly and clayey layers deposited below. The base of this channel filling contained abundant freshwater bivalve shells (Unionidae) in the south of the pit directly above the erosional contact (Fig. 1B, C). Most of the shells were abraded by fluvial transport, while a few valves were still attached to each other. The overlying sand deposits were at least



**Figure 1:** (A) Geographic situation of some *Listriodon* records from the North Alpine Foreland and the Steinheim basins; star: Oberweikertshofen; circles: 1. Steinheim 2. Derndorf, Mörgen, Tiefenried, Aspach 3. Markt Rettenbach 4. Hammerschmiede 5. St. Georgen near Dießen a. Ammersee 6. Mering 7. Friedberg 8. Stätzling 9. Prittibach 10. Großlappen, Aumeister 11. Maßenhausen, Kleineisenbach 12. Wartenberg. (B) Oberweikertshofen, sandy layers containing unionids at the basis overlying marls (October 2008). (C) Oberweikertshofen, sandy channel fillings at the top of the section (January 2008). (D) Male canine of *Listriodon splendens*, and location of the finding in the pit (arrow). Data from Dehm (1934), Van der Made (1996), Seehuber (2009), Kirscher et al. (2016) and personal data of JP.

4 m thick and rarely contained mammal bones. The screen washing was not successful and even small vertebrates were not discovered.

The fossil considered herein is a right lower male canine of a juvenile *Listriodon* (Fig. 1D). It is broken on the lingual side at 8.42 cm from the unworn but slightly damaged tip. On the labial side the breakage occurs earlier, at 5.41 cm. The measurement method is following Van der Made (1996: figure 16. Labial side: 17.26 mm; lingual side: 19.22 mm; posterior side: 19.43 mm). Those are an underestimation because they are taken near to the tip of the canine, but the tooth was larger than that of any known *Bundlistriodon* compared to the value provided by Van der Made (1996: fig. 49). Following the previous reference, the size of the male canines is of good

biostratigraphic value because it increases through time. While the present *Listriodon* tooth indicates a age not older than 14.4 Ma, it is too damaged to use it for a finer stratigraphy, and thus does not allow a more in deep evaluation of the age of the locality.

At around 14.2 Ma, major changes occurred in the faunal associations in relation to the Middle Miocene Climate Transition (MMCT; isotopic events Mi-3a, Mi-3). This stepwise and global event is characterized at its beginning by a sharp drop in temperature (Lewis et al. 2008). This cooling is evident in a gradual replacement of the evergreen forest by more deciduous and mesothermic plants (Jiménez-Moreno 2006). We speculate that vegetation changes may have played a role in the migration of *Listriodon splendens* into Central Europe. It has been interpreted as

a browser (Hunter & Fortelius 1994), not rooting (Van der Made 1996) but feeding on large quantities of herbs or other low vegetation (Van der Made et al. 2014). The assumed ecological preferences of the species may be in accordance with a more seasonal climate variability suggested for the period after 14.5–14.0 Ma (Böhme 2003; Eronen & Rößner 2007) possibly leading to a less dense vegetation. In addition, the great sexual dimorphism in the canines of *Listriodon splendens* is also seen as a morphological specific related to social behavior adapted to a more open landscape (Van der Made 2003; Van der Made et al. 2014).

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