

The Early Miocene micromammalian assemblage from Mokrá – 1/2001 Turtle Joint site (Moravia, Czech Republic) – preliminary results

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Abstract

The age of micromammalian assemblage from new Early Miocene site of Mokrá – 1/2001 Turtle Joint (*Prolagus schnaitheimensis* - an advanced form, *P. cf. vasconiensis*, Lagomorpha gen. et spec. indet., *Palaeosciurus* sp., *Melissiodon dominans*, *Megacricetodon* sp., Rodentia gen. et spec. indet., *Galerix* sp., *Lipotyphla* gen. et spec. indet., *Rhinolophus* sp. I., ?*Rhinolophus* sp. II., and Chiroptera gen. et spec. indet.) corresponds with the age of assemblages from Ořechov and Dolnice sites (MN 4). Based on found taxa, the palaeoenvironment can be defined as a karst landscape covered by open forest to open steppe with the possible presence of close water area.

Introduction

Records of the Early Miocene micromammalian assemblages are relatively frequent in Europe. Most of them are kept in karst areas or in basin deposits. In the Czech Republic, however, only six sites so far yielded fossils of the Early Miocene mammals (Fejfar, 1990). The stratigraphically oldest finds are known from the region of the both Chomutov and Most Basins in the northern Bohemia, where fossils have been found in drillings and in deposits of the main brown coal seam (Merkur-North) or in the limestone quarry and erosive relicts of hot spring travertine (Tuchořice) – Fejfar (1974). Based on their early Orleanian assemblages, the both sites are dated to the Early Miocene MN 3 Zone (Fejfar, 1990). To the contrary, the stratigraphically youngest record of the Czech Early Miocene mammalian sequence is represented by the early MN 5 assemblage of Františkovy Lázně in the Cheb Basin (western Bohemia) and related Strakonice assemblage from the Karpatian deposits of the South Bohemian Basin (Fejfar, 1974, 1990). As mid-members of

this faunal succession, the sites of Dolnice 1-3 (Cheb Basin) and Ořechov (Moravia) with the Ottnangian assemblages (MN 4) can be recognized (Fejfar, 1974, 1990). An assemblage, biostratigraphically comparable with one of the latest two sites, is now also known from Mokrá – 1/2001 Turtle Joint site, a new Early Miocene locality in the territory of Moravia.

The site is situated in the Western Quarry of the Mokrá open-cast mine about 12 km ESE of Brno on the Mokrá Plateau, which is a part of the Drahany Upland (Figure 1). It represents one of some karst fissures filled up by terrestrial fossiliferous deposits. The full detailed description of the site and its geological setting can be found in Ivanov et al. (2006).

Faunal Assemblage of Micromammals

The micromammalian fossils of the Mokrá – 1/2001 Turtle Joint site have been found during the field campaigns in 2002 to 2005, leaded by M. Ivanov and R. Musil from the Masaryk University in Brno. Thus far, nearly 400 specimens of micromammals have been studied. The

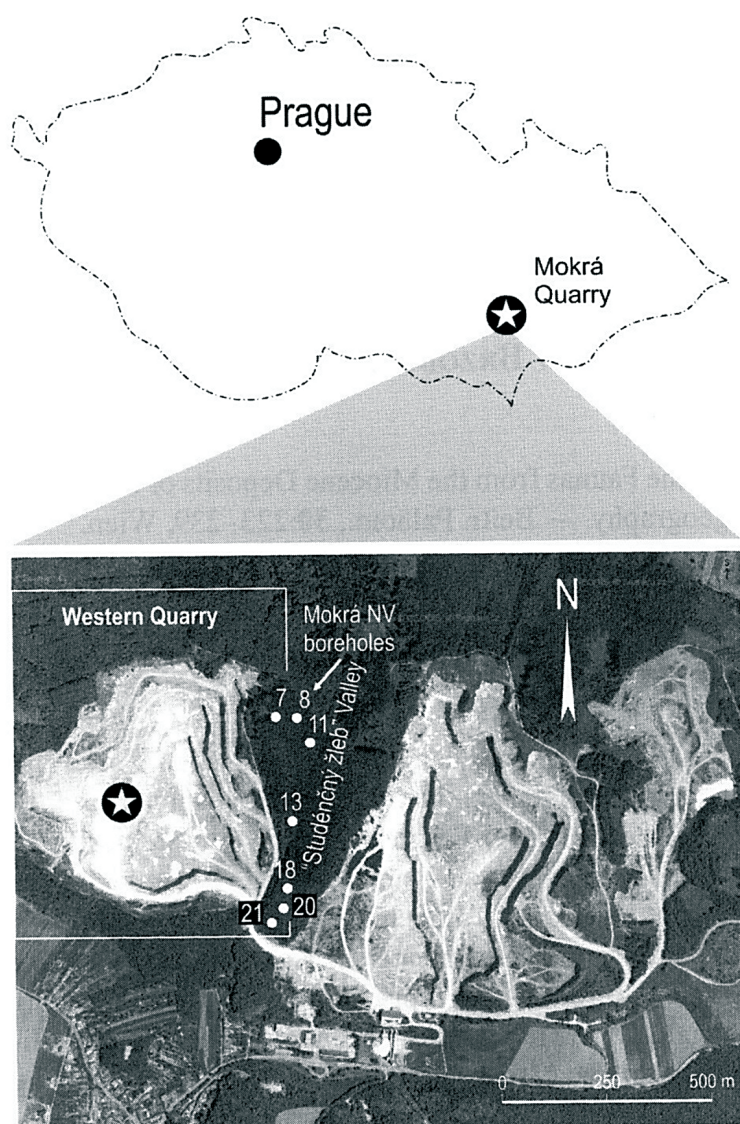


Figure 1. Location of the Mokrá open-cast mine in the Czech Republic. An asterisk indicates position of the Mokrá – 1/2001 Turtle Joint (according to Ivanov et al., 2006; modified).

fossil remains, obtained by the washing in sieves of 0.5 mm mesh (Ivanov et al., 2006), belong to lagomorphs, rodents, insectivores and bats.

Order Lagomorpha BRANDT, 1855

Family Ochotonidae THOMAS, 1897

Prolagus schnaitheimensis TOBIEN, 1975 (an advanced form)

Prolagus cf. vasconiensis VIRET, 1930

Lagomorpha gen. et spec. indet.

Fossils of ochotonids represent the largest part of the mammalian record from Mokrá – 1/2001 Turtle Joint. It consists of 88 determined teeth (1 P2, 14 P3, 11 P4, 12 M1, 10 M2, 3 M1-2, 2 P-M, 15 p3, 13 p4-m2, 5 m3, 2 p-m), which most probably belong to two forms. The most of found teeth is assigned to *Prolagus schnaitheimensis*, representing, however, some-

what more advanced form than what are known from the typical MN 3 sites (Schnaitheim or Wintershof-West). The crowns of some cheek teeth from Mokrá – 1/2001 Turtle Joint display secondary enamel corrugations of fossettes (Figure 2.1a), which differ from similar one at teeth of *Ptychoprolagus forsthartensis* by lower evolutionary level. Furthermore, teeth of *Pr. schnaitheimensis* (and also studied material from the Moravian site) are somewhat smaller than teeth of *Pt. forsthartensis*.

Besides of above mentioned remains, some discovered teeth represent a smaller form of ochotonid with a different morphology (e.g. smaller and narrower anteroconid or derived centroflexid; Figure 2.2) what can indicate the presence of *Pr. vasconiensis*.

The similar situation is known from MN 4 sites (e.g. Petersbuch 2 or Erkertshofen 1-2; Ziegler & Fahlbusch, 1986) and it can be comparable with fossil record from another Moravian site of Ořechov with almost identical forms, whereas record from Dolnice contains already more advanced forms of the *P. vasconiensis* – *P. oeningensis* lineage (particularly the morphotype “*artensis*” sensu López-Martínez, 1997).

Other fossil remains of lagomorphs (38 incisors, 12 fragments of cheek teeth, 4 fragments of calcaneal bones and 4 fragments of humeri) probably also belong to both found taxa of ochotonids, but they are so far only determined as Lagomorpha gen. et sp. indet. for their fragmentation.

Order Rodentia BOWDICH, 1821

Family Sciuridae FISCHER DE WALDHEIM, 1817
Palaeosciurus sp.

Five isolated cheek teeth (3 M1-2, 1 m1, 1 m3) and skull fragment with left P4 and M1 from the site belong to a representative of genus *Palaeosciurus* (Figures 2.3 a-c) common ground squirrel from the European Miocene with protoloph and metaloph converging towards protocone and with weak entoconid incorporated into the posterolophid. From European Miocene, three species of *Palaeosciurus* are known – *P. feignouxii* (MN 2), *P. fissurae* (MN 3 – MN 4), and *P. sutteri* (MN 4 – MN 5) (Bruijn, 1999). The fossils from Mokrá – 1/2001 Turtle Joint morphologically most of all suggest the teeth of the latest species, known also from the Austrian site of Oberdorf (MN 4 – Bruijn, 1998), Teiritzberg (MN 5) or Obergänserndorf (MN 5) (Daxner-Höck, 1998) and German sites of Forsthart (MN 4b), Langenmoosen (MN 5) or Puttenhausen (MN 5 – Ziegler & Fahlbusch, 1986). Moravian teeth, however, are somewhat smaller and so they are thus far only determined as *Palaeosciurus* sp. (or *P. aff. sutteri* respectively).

Family Melissiodontidae SCHAUB, 1925
Melissiodon dominans DEHM, 1950

This biostratigraphically youngest representative of the family Melissiodontidae is known

from the site by the find of five lower cheek teeth (1 m1 and 4 m2; Figures 2.4 a-b). The pattern of crests and pits on the occlusal surface of the molars from the Mokrá – 1/2001 Turtle Joint is very complicated, what is mainly typical for melissiodontids from the Early Miocene. The teeth, however, display more advanced morphology than teeth of *Melissiodon* from MN 3 sites (e.g. Wintershof-West; Hrubesch, 1957), what is characteristic for molars of the species from MN 4 sites, such as Dolnice or Ořechov (Fejfar, 1990).

Family Cricetidae ROCHEBRUNE, 1883
Megacricetodon sp.

Overall, only one M1 and fragment of left maxilla with M1 and M2 have so far been found at the site (Figures 2.5a-b). Based on the presence of split anterocone, the fossils were assigned to the genus *Megacricetodon*. Their small size and medium-length mesoloph can indicate a species from the group “*primitivus* – *collongensis*”. The presence of this cricetid in the studied sample of micromammals from the site is very important for the dating of fossiliferous filling. Since the first appearance of modern cricetids in Europe is connected with their immigration event during the latest Early Miocene, the terrestrial deposits of the Mokrá – 1/2001 Turtle Joint site cannot be dated to older age than is period of the MN 4 Zone. It is in good agreement with the common presence of advanced form of archaic genus *Melissiodon*, which disappears in younger stratigraphical sequences.

The same occurrence of these archaic and modern rodents is also known from Molasse Basin (Ziegler & Fahlbusch, 1986) or from Czech sites of Dolnice 3 and Ořechov (Fejfar, 1990), dated to the MN 4, or to the MN 4b Zone respectively.

Rodentia gen. et spec. indet.

Record from the studied site also contained almost 60 incisors or their fragments of undetermined rodents. Based on the above mentioned taxa, however, it is not excluded that most of these teeth can belong to sciurids, melissiodontids or cricetids.

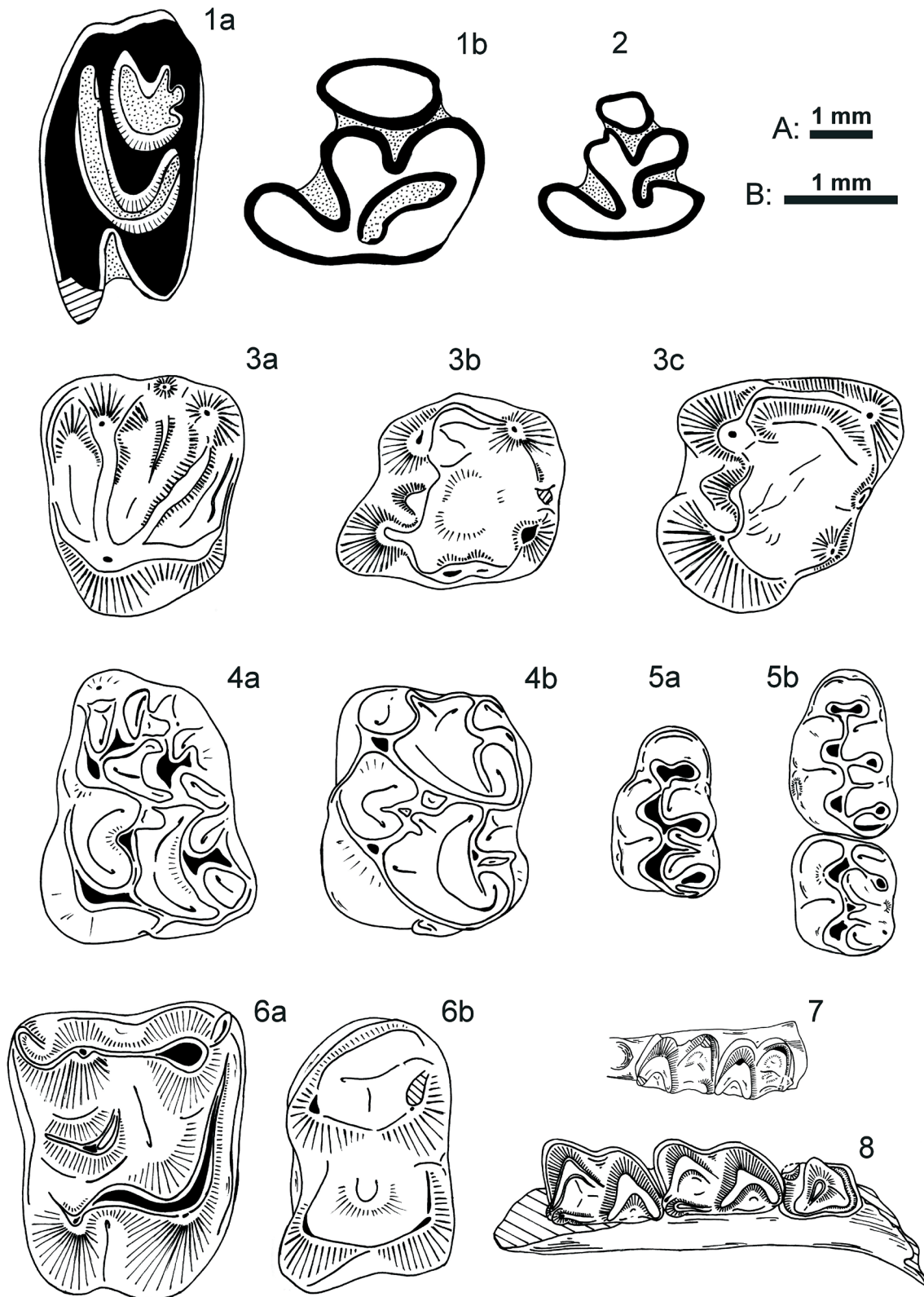


Figure 2. Finds of micromammals from the Mokrá – 1/2001 Turtle Joint site.

1. *Prolagus schnaitheimensis* (an advanced form; a – P4 sin., b – p3 sin.), 2. *P. cf. vasconiensis* (p3 sin.), 3. *Palaeosciurus* sp. (a – M1-2 sin., b – m1 sin., c – m3 sin.), 4. *Melissiodon dominans* (a – m1 sin., b – m2 sin.), 5. *Megacricetodon* sp. (a – m1 sin., b – m1 sin. a m2 sin. from the left mandible fragment), 6. *Galerix* sp. (a – M2 dext., b – m2 sin.), 7. *?Rhinolophus* sp. II. (a fragment of the right hemimandible with m1 and m2), 8. *Rhinolophus* sp. I. (a fragment of the left hemimandible with p4 to m2). Scale “A” is for bats, scale “B” is for lagomorphs, rodents, and insectivores.

Order Erinaceomorpha GREGORY, 1910

Family Erinaceidae FISCHER DE WALDHEIM, 1817

Galerix sp.

The genus *Galerix* is of the most common echinosoricines in the European Miocene. From the Mokrá – 1/2001 Turtle Joint site, it is only known by finds of toothless hemimandibles, 2 m2, and 2 M2, which are very important for exact species determination (Figures. 2.6a). One of these upper molars, however, is only fragmentary preserved, whereas second one displays the straight anterior arm of the metacone and the absence of the protocone-metaconule connection. Thus, *Galerix* species from Mokrá – 1/2001 Turtle Joint differs from the Early Miocene species of the genus (*G. aureliensis*, *G. symeonidisi*) and it is similar in appearance to the new species of the genus, described by Doukas and Hoek Ostende (2006) from the MN 4 site of Karydia (Greece) as *G. kostakii*. The molars of Moravian *Galerix*, however, are somewhat narrower (mainly m2s).

Lipotyphla gen. et sp. indet.

Insectivores from the studied site are also represented by undetermined fragment of toothless hemimandible (differing from the abovementioned hemimandibles of *Galerix*), two fragments of talpid ulnas and probably some fragments of incisors and bones (?).

Order Chiroptera BLUMENBACH, 1779

Family Rhinolophidae GRAY, 1825

Rhinolophus sp. I. (“*R. aff. lemanensis* – *R. delphinensis*” group)

?*Rhinolophus* sp. II. (“*R. grivensis* – *R. similis*” group)

So far, two species of bats are found at the site, represented by two hemimandible fragments with dentition (Figures 2.7-8) and the distal part of left humerus. These remains are assigned to the genus *Rhinolophus* on the basis of morphology of preserved teeth and the bone. The humerus fragment and the left hemimandible with p4-m2 belong to a larger form, one of those that used to be attributed to “*R. ferrumequinum*” group. Members of this group represent the dominant component of the Miocene

chiropteran assemblage of Central Europe. The taxonomic status of particular populations and relationship of the nominal species of this group (*lemanensis* REVILLIOD, 1920, *delphinensis* GAILLARD, 1899, *cluzeli* HUGUENEY 1963, aff. *lemanensis* sensu ZIEGLER 1993) present an open question. Our specimens correspond well to *R. aff. lemanensis* from MN 3 site of Wintershof-West (Ziegler, 1993) and MN 3 site of Stubersheim 3 (Ziegler, 1994) in size and proportion of dentition, but it differs from the both and from the Middle Miocene *R. delphinensis* in form of p4. The species identification of the smaller fragment of right hemimandible with m1 and m2 is even more complicated. Its dimensions fall below the limits of *R. dehmi* Ziegler, 1993, the smaller form accompanying *R. aff. lemanensis* in Wintershof-West and Stubersheim 3. It corresponds to the Middle Miocene forms of *R. grivensis* (DÉPERET, 1892), including *R. similis* ZAPFE, 1950. Nevertheless, rhinolophids represent a greatly diversified group with a considerable span of both stratigraphic and geographic distribution whose fossil record is still not well understood (Storch, 1999). For this reason, the interpretation of the fragments from Mokrá – 1/2001 Turtle Joint remains rather an open question.

Chiroptera gen. et sp. indet.

Besides of above mentioned remains of bats, the chiropteran material also includes a fragment of toothless hemimandible and three bone fragments of wing bones (metacarpal? and phalanges), which do not allow any exact identification.

The rest of found fossils is represented by undetermined fragments of teeth and post-cranial elements of various (micro-)mammals, assigned so far to the Mammalia gen. et sp. indet. only.

Palaeoecology and biostratigraphy

Extant species of lagomorphs prefer the open lands; forest- or riparian-dwelling lagomorphs are rare. However, the Early Miocene pikas from Central Europe, abundantly appearing in the lacustrine limestones and coal seams of the North Bohemian basins (Fejfar & Kvaček, 1993), can

be regarded rather as a forest-dweller or even a peri-aquatic riparian pikas, though their living in more forest-open areas cannot be excluded in this case. *Palaeosciurus* belongs among so called ground squirrels. They are burrowing diurnal sciurids (Bruijn, 1999) feeding mainly on grains and living in more open environment. Teeth of *Melissiodon* suggest frugivorous diet (Mein & Freudenthal, 1981) within forested area (Agustí & Antón, 2002). *Megacricetodon* as ground dweller could indicate open-forest conditions, but this genus is very opportunistic (Källin, 1999) and so the precise definition of its habitat is more or less impossible. The recent close relatives of *Galerix* from the subfamily Echinoricinae live in forested environments, often close to water, where they feed on invertebrates, fishes, frogs as well as on some plant matter (Ziegler, 1999). The similar ecological conditions are also assumed for erinaceids from Mokrá – 1/2001 Turtle Joint. The appearance of rhinolophid bats, which are strict cave-dwellers foraging in foliage suggests that the fossiliferous site represented a spacious cave in time of deposition, situated supposedly in a forest or semi-opened karstic vegetation. In general, the mammalian assemblage from the studied site indicates a warm climate with a variegated vegetation covers including both the patches of open steppe to open-forest karst landscape with the possible presence of a water streams of marshy area. It is in good agreement with palaeoecological conclusions of Ivanov et al. (2006).

For the determination of stratigraphical age, the record of rodents is very important. The co-occurrence of archaic *Melissiodon dominans* with modern *Megacricetodon* sp. indicates the Early Miocene MN 4 Zone, when the last representatives of melissiodontids disappeared from Europe and the first modern cricetids immigrated to the Continent from Asia (Mein, 1999). This age of the site is also supported by finds of other micromammals (mainly of lagomorphs) as well as by finds of macromammals and reptiles (Ivanov et al., 2006). Furthermore, the more advanced morphology of found ochotonid and rodent teeth provides evidence for the correlations of assemblage from the Mokrá – 1/2001

Turtle Joint site with MN 4 assemblages of other Czech sites, especially of Ořechov and Dolnice respectively (Fejfar, 1990).

Conclusion

The micromammalian assemblage from the Mokrá – 1/2001 Turtle Joint site, consisting of preliminary determined taxa of lagomorphs (*Prolagus schnaitheimensis* - an advanced form, *P. cf. vasconiensis*, Lagomorpha gen. et sp. indet.), rodents (*Palaeosciurus* sp., *Melissiodon dominans*, *Megacricetodon* sp., Rodentia gen. et sp. indet.), insectivores (*Galerix* sp., Lipotyphla gen. et sp. indet.), and bats (*Rhinolophus* sp. I., ?*Rhinolophus* sp. II., Chiroptera gen. et sp. indet.), indicates the Early Miocene age (MN 4). This age of the locality corresponds with the biostratigraphical level of Ořechov and Dolnice sites. However, the environmental conditions on the correlated sites were somewhat different. Whereas Dolnice (marshy sequence of main brown coal seam) and Ořechov (marine-estuarine sediments) represent wet environment, the Mokrá – 1/2001 Turtle Joint site was a part of the karst landscape covered by open forest to open steppe in the time of the deposition of fossiliferous sediments.

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