Cretaceous Research 57 (2016) 228–238

Contents lists available at ScienceDirect

Cretaceous Research

journal homepage: www.elsevier.com/locate/CretRes

Vertebrate remains from the Upper Cretaceous (Santonian) Ajka Coal Formation, western Hungary

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ARTICLE INFO

Article history:
Received 20 February 2015
Accepted in revised form 27 April 2015
Available online 15 September 2015

Keywords:
Late Cretaceous
Continental vertebrates
Swampy environment
Dinosaurs
Hungary

ABSTRACT

Vertebrate remains from the Upper Cretaceous (Santonian) Ajka Coal Formation (Bakony Mountains, western Hungary) are described. Macro- and microfossils collected from two boreholes and from isolated chunks of sediment/matrix dumped on spoil heaps of the Jókai Mine represent pycnodontiform and lepisosteiform fishes, bothremydid turtles, the mosasauroid *Pannoniasaurus inexpectatus*, the crocodyliforms cf. *Theriosuchus*, *Iharkutosuchus makadii* and cf. *Allodaposuchus*, as well as ankylosaurian and theropod dinosaurs. This unit was deposited in a swampy lacustrine environment, in contrast with the neighbouring and contemporaneous floodplain deposit of the vertebrate-bearing Csehbánya Formation at Iharkút. Despite significant environmental differences, the faunal composition of the Ajka Coal Formation assemblage completely overlaps with that of the Csehbánya Formation, suggesting the occurrence of the same semi-aquatic and terrestrial species in both settings. The ankylosaurian remains further strengthen the previous view that ankylosaurus preferred wetland habitats such as fluvial systems and coastal regions.

1. Introduction

Vertebrate remains from the Mesozoic of Hungary are relatively rare and aside from a few isolated (occasionally articulated) remains only two localities are known to provide systematically collectable assemblages. In geochronological order, the first one is situated at Villány (Villány Hills, southwestern Hungary), and includes two outcrops of the Middle Triassic (Ladinian) Templomhegy Dolomite Member (Csukma Dolomite Formation) and the Upper Triassic (Carnian) Mészhegy Sandstone Formation. Recent systematic excavations and screen-washing of the fossiliferous beds have resulted in both macro- and microfossils of different groups of marine vertebrates (Ősi et al., 2014). The second locality is the Upper Cretaceous (Santonian) Iharkút (Bakony Mts, western Hungary) where excavations of the bone-bearing horizons of the Csehbánya Formation have yielded a diverse and rich continental-freshwater fauna during the past 14 years (Ősi et al., 2012).

Prior to the discovery of the Iharkút locality in 2000, some isolated bones and teeth were already known from the Upper Cretaceous Ajka Coal Formation (deposited roughly contemporaneously with the Csehbánya Formation), suggesting the potential for finding vertebrate-bearing horizons within the unit. Most of these specimens, however, were found by chance during the 140 years of underground coal mining activities (started in 1865) in the Ajka-Felső-Csinger-Gyepükaján Zone.

The first mention of a vertebrate fossil from the Ajka Coal Formation was made by Leopold Tausch (1886: 26), who presented merely a short note on a 'small reptile or fish tooth fragment' in his detailed review on the molluscan fauna of the Ajka coal beds. Unfortunately, most of the type specimens of the different molluscan species (Bandel and Riedel, 1994) or the precise location of this tooth cannot be identified.

The next discoveries of vertebrates in the Ajka coal beds were linked to extensive exploration drilling by the coal and bauxite mining industries in the area during the 1980s. Various specimens were collected from cores and deposited in the collections of the Geological and Geophysical Institute of Hungary (MFGI, formerly Hungarian Geological Institute: MÁFI), but these have never been studied in detail. In 2013, due to rearrangement of the MFGI

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http://dx.doi.org/10.1016/j.cretres.2015.04.014
0195-6671/

vertebrate collections, some specimens and pieces of bone-bearing cores were brought to the attention.

During the search for Cretaceous vertebrates in the Bakony Mountains in 1999 and 2000, the first specimens discovered were isolated fish and crocodilian teeth and a few bone fragments from the Upper Cretaceous (Santonian) Ajka Coal Formation. These specimens were recovered either by breaking up chunks of coal-bearing matrix dumped on spoil heaps of the Ajka collieries or collected by screen-washing these rocks. Recently, more screen-washing of approximately 60 kg of matrix collected in 2012 from these spoil heaps was conducted, yielding most of the micro-vertebrate remains described here.

In the present paper, we record these fragmentary but taxonomically important vertebrate fossils and discuss their palaeoecological implications in the light of vertebrate faunas of the contemporaneous Csehbánya Formation at Iharkút.

2. Localities and geological setting

2.1. Localities

Vertebrate remains from the Ajka Coal Formation have been collected from cores of the Káptalanfa-2 (from 803 m; final depth: 847.8 m) and Gyepükaján-12 (from 473 m; final depth: 606.3 m)

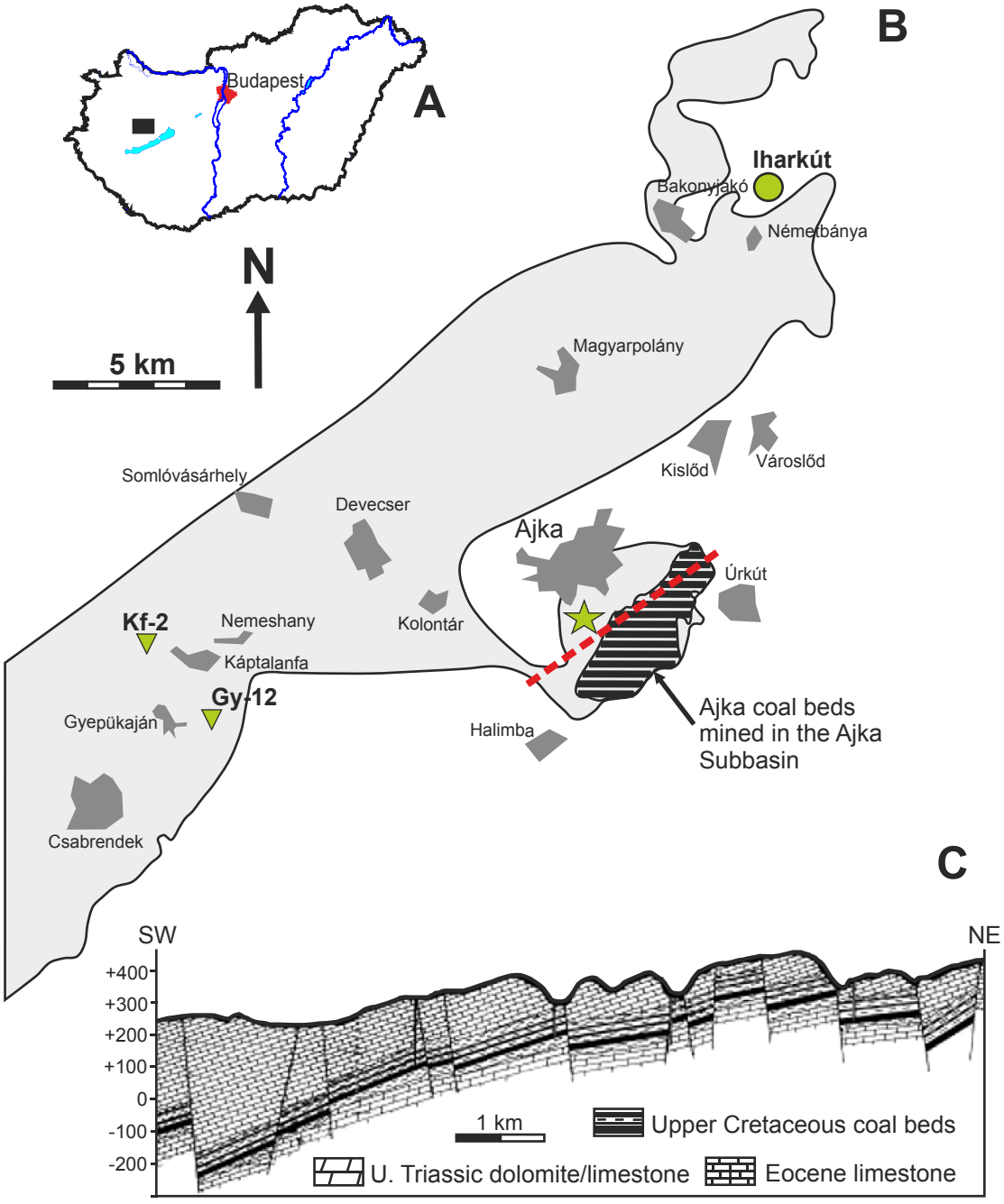

Fig. 1. Localities yielding Late Cretaceous vertebrate fossils, distribution and geology of the Ajka Coal Formation; (A) location of the Ajka Coal area in western Hungary; (B) distributional map of the Ajka Coal Formation (light grey) with position (green triangles) of boreholes Káptalanfa-2 (Kf-2) and Gyepükaján-12 (Gy-12) (after Császár and Góczán, 1988), the spoil heaps of the Jókai Mine in the Ajka Subbasin (green asterisk), and the locality of Iharkút (green circle). The red dashed line shows the position of the section in C; (C) simplified geological section of the Ajka Subbasin (after Kozma, 1991). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)