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Ursula B. Göhlich & Andreas Kroh (Eds)



A review of avian remains from the Oligocene of the Outer Carpathians and Central Paleogene Basin

ZBIGNIEW M. BOCHENSKI¹, TERESA TOMEK¹ & EWA SWIDNICKA²

¹ Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland; E-mail: bochenski@isez.pan.krakow.pl, tomek@isez.pan.krakow.pl

² Division of Palaeozoology, Department of Evolutionary Biology and Ecology, University of Wrocław, Wrocław, Poland; E-mail: gama@biol.uni.wroc.pl

Abstract — The paper is a brief review of avian specimens that were found in marine deposits of the Paratethys in the Oligocene sites of Poland, Slovakia and Czech Republic. It provides additional information on the localities and comments on their faunas.

Key words: Oligocene, birds, Poland, Slovakia, Czech Republic, Paratethys

Introduction

Several bird specimens were described from the Oligocene of Poland, Slovakia and Czech Republic during the last few years. This paper summarizes our knowledge on the avian specimens from that part of the Paratethys and presents additional information on the sites.

During the Oligocene, large parts of central and eastern Europe were covered by the Paratethys, a northern branch of the Tethys Ocean (Fig. 1). During the Alpine orogeny, the Paratethys was separated from the Tethys by the Alps, Carpathians and other mountains but the separation was not a single event because the Paratethys was at times reconnected with the Tethys. It gradually became shallower and finally disappeared during the Late Miocene, becoming an isolated inland sea. Today's remnants of the Paratethys include the Black Sea, Caspian Sea and Aral Sea (Rögl 1999; SCHULZ *et al.* 2005).

The Menilite beds of the Carpathian flysch zone (northeastern Czech Republic and south-

eastern Poland) and the Central Paleogene basin (northern Slovakia) are very rich in Oligocene fish fossils. The ichthyofauna is not only very rich and diverse but also very characteristic for particular strata. Therefore the palaeoecological assemblages are successfully used in biostratigraphy, especially in the Polish part of the Carpathians (Fig. 2). The fish-bearing levels have been assigned to the respective IPM (Ichthyofauna, Paleogene, Menilite-Krosno Series) zones (IPM1 to IPM6) and correlated with the calcareous nannoplankton in the standard zonation (comprising NP22 to NP25 zones) and together they indicate the geological age (KOTLARCZYK & JERZMAŃSKA 1976; KOTLARCZYK et al. 2006). In Poland, many thousand of fish fossils have been recovered mainly during the late 1970s until the mid 1990s from more than 200 outcrops (Kot-LARCZYK et al. 2006). Since that time many of the localities have been overgrown with vegetation and partly or completely destroyed by natural processes or people. The state of preservation of the sites (Fig. 3) that yielded avian remains and



FIGURE 1. Early Oligocene paleogeography, with all known sites with bird remains from Poland, Slovakia and Czech Republic (inlet). Grey areas indicate the extent of the Oligocene sea. Modified from RögL (1999).

their GPS positions (Tab. 1) were recorded during a survey of Polish sites conducted between 2010 and 2012.

Animal fossils other than fishes are found only sporadically in the Carpathian Flysch. Birds are also extremely rare (BOCHENSKI et al. 2012). They are usually preserved as incomplete but articulated imprints on slabs; only on one occasion (?Diomedeoides lipsiensis from Pogorzany, Poland) a three-dimensional bone fragment was extracted from a breccia (Tab. 1). Skeletons or their fragments remain in articulation in marine environments only if they reach the burial place soon after death because soft tissues begin to decompose rapidly and skeletal elements disarticulate fast (SCHÄFER 1972). Therefore, it seems that all but one of the birds must have got into the water, drowned and sank to the bottom rather than being transported in streams or flushed to the sea. This is in agreement with taphonomic studies carried out on fish remains where it was suggested that articulated fish specimens have been preserved due to a quiet environment, pelagic sedimentation and anoxic conditions (BIEŃKOWSKA-WASILUK 2010; KOTLARCZYK et al. 2006). The single bone from Pogorzany (Poland) was probably deposited as a result of submarine debris flow or turbidity currents (ELZANOWSKI *et al.* 2012).

The avifauna

The nine avian specimens described so far from the marine deposits of eight localities of the Outer Carpathians and Central Paleogene Basin represent taxonomically very diversified groups: Procellariiformes (ELZANOWSKI et al. 2012; GREGOROVÁ 2006), Apodiformes (BOCHENSKI & BOCHENSKI 2008), Coraciiformes (KUNDRAT et al. in press), Piciformes (MAYR & GREGOROVÁ 2012), Passeriformes (BOCHENSKI et al. 2011, 2013, in press) and Aves indet. (BOCHENSKI et al. 2010). A big taxonomic diversity of fossil birds points to complex habitats and very rich avifauna in that part of the Paratethys which agrees with the fossil records from other parts of Europe (MAYR 2009). It is noteworthy that seven of the nine specimens are land birds that must have lived in the forests near the shoreline and were blown off to sea or perished during migration. The predominance of terrestrial birds in marine deposits is not an

FIGURE 2. Chronostratigraphy of the Oligocene. The characteristic ichthyofaunal zones (IPM) are correlated with the calcareous nannoplankton zonation (NP) and together they indicate the geological age. Modified from KOTLARCZYK *et al.* (2006).

unusual phenomenon (MAYR 2009). A similar tendency is also observed in many other Paleogene localities including the Eocene Fur Formation of Jutland in Denmark (KRISTOFFERSEN 2002) and London Clay Formation in southern England (MLIKOVSKÝ 2002), as well as in the Oligocene Wiesloch-Frauenweiler in southern Germany (MAYR 2009). In addition to skeletal specimens, a number of isolated feather imprints have been found in the Carpathians. These specimens are housed in various collections and are sometimes mentioned in the publications but none of them

		Chronos	Ichthiofauna zones	
Time (Ma)	Standard			
²⁴ 1		\sim		
-		Chattian	NP25	IPM6
27 -	ШN			
1	GOCE		NP24	IPM5
-		Rupelian		IPM4
	Ē			IPM4A
30 -	0		NP23	IPM3
-				IPM2
			NP22	IPM1
33 -	ш	Priabonian	NP21	

TABLE 1. Data on all avian specimens from the Oligocene of the Outer Carpathians and Central Paleogene Basin. Asterisk (*) indicates approximate geographic coordinates.

Taxon	Preservation	Coordinates	Age	Publications	Site
Procellariiformes					
?Diomedeoides lipsiensis (FISCHER, 1983)	isolated coracoid	49°47.06' N 20°10.49' E	Rupelian	Elzanowski <i>et al.</i> (2012)	Pogorzany*
Procellariidae	part of wing and legs	49°11.56' N 17°12.16' E	Rupelian	Gregorová (2006)	Litenčice*
Apodiformes					
Eurotrochilus noniewiczi Bochenski & Bochenski, 2008	nearly complete	49°37.94' N, 021°40.44' E	Rupelian, NP23, IPM2	Bochenski & Bochenski (2008)	Winnica
Coraciiformes					
Putative upupiform	articulated leg	49°00.20' N 21°32.39' E	Rupelian	Kundrat <i>et al.</i> (in press)	Bystré nad Topľou*
Piciformes					
<i>Picavus litencicensis</i> Mayr & Gregorová, 2012	postcranial ske- leton	49°11.56' N 17°12.16' E	Rupelian, NP23	Mayr & Gregoro- vá (2012)	Litenčice*
Passeriformes					
Jamna szybiaki Bochenski, Tomek, Bujoczek, Wertz, 2011	nearly complete	49°38.67′ N, 022°33.52′ E	Rupelian, NP23,IPM2	Воснелякі <i>et al.</i> (2011)	Jamna Dolna
<i>Resoviaornis jamrozi</i> Bochenski, Tomek, Wertz, Swidnicka, 2013	nearly complete	49°59.25′ N, 022°09.53′ E	Rupelian, NP24, IPM4	Воснелякі <i>et al.</i> (2013)	Wola Rafałowska*
Passeriformes indet.	articulated leg	49°43.98' N, 022°03.02' E	Rupelian, NP24, IPM4A	BOCHENSKI <i>et al.</i> (in press)	Przysietnica
Aves indet.					
Aves indet.	articulated foot	49°46.18' N, 022°29.52' E	Chattian, NP25, IPM6	Bochenski <i>et al.</i> (2010)	Bachów



FIGURE 3. Photographs of Polish Oligocene sites that yielded avian remains. **A**, Bachów: high bank of a stream (an avian foot of inresolved affinities); **B**, Winnica: high bank of the Jasiolka River (a near-complete hummingbird, *Eurotrochilus noniewiczi*); **C**, Przysietnica: steep slope bordering a dirt road (a passerine leg); **D**, Jamna Dolna: high bank of Jamninka stream, a tributary of the Wiar (a near-complete passerine, *Jamna szybiaki*); **E**, Wola Rafałowska: high bank of a stream, a tributary of the river Strug (a near-complete passerine, *Resoviaornis jamrozi*); **F**, Pogorzany: high bank of a stream (an isolated coracoid of ?*Diomedeoides lipsiensis*). has been described so far, probably because they are not attributable to particular avian taxa (BIEŃKOWSKA-WASILUK 2010; BOUÉ 1829; KALA-BIS 1950; personal observations). The fossil record from Poland, Slovakia and Czech Republic increases our knowledge on the Oligocene bird fauna of Europe by at least four new taxa.

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