C.-M. Jianu[1] & G.J. Boekschoten[2]
[1] Muzeul Dacice çi Romane, Deva
[2] Instituut voor Aardwetenschappen, Amsterdam

The Hateg - island or outpost?

Jianu, C.-M. & Boekschoten, G.J., 1999 - The Hateg - island or outpost? - in: Reumer, J.W.F. & De Vos, J. (eds.) - ELEPHANTS HAVE A SNORKEL! PAPERS IN HONOUR OF PAUL Y. SONDAAR - DEINSEA 7: 195-198 [ISSN 0923-9308]. Published 10 December 1999

The Hateg upper Cretaceous island concept was coined by Franz Baron Nopcsa in 1912 and has held ever since. After a review of the tectonic, sedimentological and paleontological data available, it is concluded that neither the tectonic background nor the sediment infilling make the Hateg basin a probable island site. The balanced vertebrate fauna also suggests a continental setting. The peculiar features of some of its constituents rather suggest vicariant developments along a long and not very wide mountain range, projecting from the southeast into the epicontinental seas of upper Cretaceous Europe. Hateg was not an island; it was an outpost.

Correspondence: C.-M. Jianu, Muzeul Dacice çi Romane, Deva, Romania; G.J. Boekschoten, Instituut voor Aardwetenschappen, Vrije Universiteit, De Boelelaan 1085, NL- 1081 HV Amsterdam, The Netherlands

Keywords: island evolution, dinosaurs, Cretaceous

INTRODUCTION

The Hateg upper Cretaceous island concept was coined by Franz Baron Nopcsa when he lectured, 27th November 1912, in Vienna at a session of the Zoologische Botanische Gesellschaft, section Paleontology and evolutionary sciences. According to a short abstract (Nopcsa 1914) he pointed out that all Transsylvanian dinosaurs were notably smaller than their northern American and east African counterparts. Their diminutive size, then, was compared with the nanism of Mediterranean Pleistocene island elephants. During discussion, Abel concurred with this isolation idea, and pointed to the dwarfing of Mediterranean *Hippopotamus*, as well as to island gigantism. Nopcsa and Abel referred to earlier work by Forsyth Major on Malta, and - then new - discoveries by Miss D.M.A. Bate on Cyprus and Crete. The Hateg island concept has held, and it even became quite explicit. According to Weishampel *et al.* (1991) and also to Benton (1996) the island measured about 7,500 km2, and it lay in an archipelago some 200 to 300 km from the nearest mainland mass in northern Europe. The sediments consist of river deposits with tropical soils, and here and there, ashes, testifying to continuing volcanic activity and uplift of the island.

After 86 years, much new information has been gathered on the Hateg, and on fossil island faunae. The aim of the present paper is to review some constraints for reconsidering the Hateg island concept. It was the good fortune of the second author to join with Paul Sondaar on Crete, Cyprus, Mallorca and Menorca when he started his career as an island addict.

TECTONIC ASPECTS

A recent summary is presented by Sanders (1998). Tectonic compression in the area starts in the early Cretaceous, and lasts into the late Cretaceous; it is caused by the mutual collision between microplates (Burchfiel 1980). The origin of these continental fragments is controversial. The compressional structures are covered by undisturbed late Cretaceous sediments, marking the end of the compressional event within the fragments. A late Alpine tectonic episode started in the early Miocene, resulting in large strike-slip faulting in the area. A regional update is given by Ziegler (1987). In his plate 16, the main positive areas (putative landmasses) during the Turonian-Campanian in Europe are the fold belts that prolong from Turkey by Greece on to the Alps. The fact that dinosaurs lived on these ranges is proven by finds of 'early Senonian' hadrosaur bones at Duino, Italy (Brazzati & Calligaris 1995). Apparently the adjacent shallow Karst carbonate platform was colonized from the fold belt. This extensive SE European-Levantine landmass was bordered to the north and west by one larger island (Fennosarmatia) and many smaller islands (the Iberian meseta, the Ebro high, the Corsica-Sardinia high, the Massif Central, the Armorican massif, Cornwall, Ireland, Caledonia and the Rhenish massif). Ziegler's (1987) plate 17 gives the early Tertiary situation: the anorogenic islands have fused into one large European landmass. The fold belts of SE Europe are still bordered by narrow deep seas, but the Moesian platform is a wide corridor between fold belts and cratons. Modern tectonic data, thus, suggest Hateg as about the least probable island site in the late Cretaceous!

SEDIMENTOLOGICAL ASPECTS

Nopcsa (1905) already described the Hateg deposits as largely fluviatile with some lacustrine intercalations. He wondered about these gigantic formations that stand isolated; their thicknesses would add up to 2,500 metres. The deposits were studied sedimentologically by Anastaiu & Ciobuca (1989). Marine sediments of Campanian - early Maastrichtian age are overlain by the 4 km thick Densus-Ciwa formation, consisting of alluvial fan deposits merging into lacustrine deposits. The Sinpetru of roughly equal age was deposited in a braided river environment and is at least $2^1/_2$ km thick. Continental deposits of such thickness are not found on any actual Mediterranean island, be it admitted that part of the Hateg clastics was fresh volcanic material. Much of the detritic material must have been derived from newly elevated Cretaceous mountain ranges, and was deposited in a rapidly subsiding restricted sedimentary basin.

PALEONTOLOGICAL ASPECTS

Islands are known for their restricted faunas. But the Hateg fauna is, in contrast, reasonably diverse and includes a good sample of undisputed mainland taxa from other parts of the world. New research adds steadily more species (Grigorescu *et al.*, 1998). The fossil vertebrates of the Hateg area are listed below:

Osteichthyes
- Chondrostei
  - Acipenseriformes indet.
- Teleostei
- Characiformes
  - Characidae indet.

Amphibia indet.
- Discoglossid anurans
  - Albanerpetonid lissamphibians

Reptilia
- Lepidosauria
  - Squamata indet.
- Testudines
  - Casichelydia
    - Selmacryptodira
      - Fam. Kallokibotionidae
        - *Kallokibotium bajazidi*
- Archosauria
  - Crocodylia

Eusuchia
Crocodilidae
Allodaposuchus praecedens
Doratodon sp.
Alligatoridae
Musturzabalsuchus sp.
Acynodon sp.
Saurischia
Sauropoda
Titanosauridae
Magyarosaurus dacus
Theropoda
Carnosauria indet.
"Megalosaurus" hungaricus
Troodontidae indet.
Ceratosauria indet.
Tetanura (non Maniraptora)
Heptasteornis andrewsi
Bradycneme draculae

(Maniraptora)
Dromaeosauridae
Elopteryx nopcsai
cf. *Saurnitholestes langstoni*
Velociraptorinae
cf. *Euronychodon* sp.

Ornithischia
Ornithopoda
Euornithopoda indet.
Euornithopoda incertae sedis
Rhabdodon priscus

Hypsilophodontia

Hadrosauridae
Telmatosaurus transsylvanicus

Ankylosauria
Nodosauridae
'*Struthiosaurus*' *transilvanicus*

Pterosauria
Pterodactyloidea
Ornithocheiridae
cf. *Ornithodesmus* sp. / *Pteranodontidae* indet.

Mammalia
Multituberculata
Barbatodon transsylvanicus
(= *Paracimexomis dacicus*)
Kogaionon ungureanui

If the fauna is not as large as elsewhere, this may be also due to the restricted area in which sediments were preserved and are accessible for collection: some 15x21 km, at most. But the fauna is, as such, not unbalanced: a variety of Hateg herbivores and at least one large predator are present. There are not any morphological peculiarities of Hateg dinos that would make them better swimmers than many mid-continent species at other places. This then does not indicate dispersal towards a Hateg volcanic island arising from the sea. Native volcanic islands anyhow are not often part of a vicariant distribution pattern, resulting from the breakup of a former larger area. Understandably, vicariance is considered by Weishampel *et al.* (1991). But then a new problem arises: as yet there is not much known about continentality in the Premaastrichtian of the area.

A solid argument, though, for vicariance constitutes the primitive level within the hadrosaurid clade of *Telmatosaurus transsylvanicus*, as stressed by Weishampel *et al.* (1991). Moreover, Grigorescu *et al.* (1998) stress the primitiveness and endemicity of the Hateg microvertebrates. A singular development in island animals is aberrant size, classic ever since Forsyth Major found on Malta an extinct fauna with dwarf elephants and hippos, yet giant dormice and swans. The small size of *Telmatosaurus transsylvanicus* prompted Nopcsa (1914) to adopt the island idea, and has been underscored by Weishampel *et al.* (1991). Research on *Magyarosaurus dacus* by Jianu & Weishampel (1998) gave parallel results; this sauropod was a heterochronic dwarf. Gigantism, such as seen in oceanic island turtles and in Komodo monitor lizards (*Varanus komodoensis*) has not been observed in the Hateg material.

CONCLUDING REMARKS

Neither its tectonic background nor its sediment infilling make the Hateg basin a probable island site. The balanced vertebrate fauna also suggests a continental setting. The peculiar features of some of its constituents rather suggest vicariant developments along a long and not very wide mountain range, projecting from the southeast into the epicontinental seas of upper Cretaceous Europe. Hateg was not an island; it was an outpost.

REFERENCES

Anastaiu, N. & Ciobuca, D., 1989 - Non-marine uppermost Cretaceous deposits from Stein-Densus region (Hateg Basin); sketch for a facies model - Revue Roumaine de Géologie, Géographie 33: 43-53

Benton, M., 1966 - The Penguin historical atlas of dinosaurs - Penguin Group, London

Brazzatti, T. & Calligaris, R., 1995 - Studio preliminare di reperti ossei di dinosauri del Carso Triestino - Atti mus. Civ. Stor. Nat. Trieste 46: 221-226

Burchfiel, B.C., 1980 - Eastern European alpine system and the Carpathian orocline as an example of collision tectonics - Tectonophysics 63: 31-61

Grigorescu, D., Venczel, M., Csiki, Z. & Limberea, R., 1998 - Microvertebrates from the uppermost Cretaceous dinosaur-bearing deposits of the Hateg basin (Romania) - Abstracts Third European Workshop Vertebrate Palaeontology, Maastricht: 27-28

Jianu, C.-M. & Weishampel, D.B., 1998 - The smallest of the largest: a new look at possible dwarfing in sauropods - Abstracts Third European Workshop Vertebrate Palaeontology, Maastricht: 36

Nopcsa, F. Baron, 1905 - Zur Geologie der Gegend zwischen Gyulafehervar, Deva, Ruszkabanya und der Rumänischen Landesgrenze - Mitt. Jahrb. Kön. Ungarischen Geologischen Anstalt 14 (4)

Nopcsa, F. Baron, 1914 - Über das Vorkommen der Dinosaurier in Siebenbürgen - Verh. Zool. Bot. Gesellschaft 54: 12-14

Sanders, C., 1998 - Tectonics and erosion; a fission track study of the Romanian Carpathians - Thesis, Free University, Amsterdam

Weishampel, D.B., Grigorescu, D. & Norman, D.B., 1991 - The Dinosaurs of Transylvania - National Geographic Research & Exploration 7: 196-215

Ziegler, P.A., 1987 - Evolution of the Arctic-North Atlantic and the Western Tethys - A.A.P.G. Memoir 43. Tulsa, Oklahoma

received 21 December 1998

DEINSEA - ANNUAL OF THE NATURAL HISTORY MUSEUM ROTTERDAM
P.O.Box 23452, NL-3001 KL Rotterdam The Netherlands