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Distribution of late Maastrichtian pachydiscid and scaphitid ammonites in the Maastricht and Kunrade formations of the southeast Netherlands

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ABSTRACT

The pachydiscid *Pachydiscus* (*Pachydiscus*) *gollevillensis* (d'Orbigny, 1850), long held to be confined to the 'Kunrade Limestone' (nowadays Kunrade Formation) in the eastern part of southern Limburg (Kunrade–Benzenrade area, the Netherlands), is now recorded from the basal Nekum Member (Maastricht Formation) at the ENCI-HeidelbergCement Group quarry, Sint-Pietersberg (Maastricht). Here we review the stratigraphic distribution of pachydiscid and scaphitid ammonites in outcrops west of the River Maas (Maastricht Formation) and in the Kunrade–Benzenrade area (Kunrade Formation). The latter unit has been correlated with part of the Lanaye Member (Gulpen Formation) up to the basal Emael Member (Maastricht Formation). However, pachydiscids such as *P.* (*P.*) *gollevillensis*, *P.* (*P.*) *noetlingi* Kennedy, *in* Fatmi and Kennedy, 1999 and *Menuites fresvillensis* (Seunes, 1890), as well as two scaphitid taxa (*Hoploscaphites pungens pungens* (Binkhorst van den Binkhorst, 1862) and *H. felderi* Kennedy, 1987) and a single diplomoceratid, *Diplomoceras cylindraceum* (Defrance, 1816), suggest that also equivalents of the Nekum Member (Maastricht Formation) are represented in the Kunrade–Benzenrade area.

1. Introduction

In the extended type area of the Maastrichtian Stage (Fig. 1), baculitids and scaphitids are the commonest ammonoid taxa, both in the Maastricht and Kunrade formations (Table 1). In general, pachydiscids are comparatively rare, *Pachydiscus* (*P.*) *jacquoti jacquoti* (Seunes, 1890) and *Menuites fresvillensis* being the most frequently encountered species. *Pachydiscus* (*P.*) *gollevillensis* has long been considered to occur exclusively in the Kunrade–Benzenrade area in the eastern part of southern Limburg (the Netherlands), but here we document a recent find from the basal Nekum Member of the Maastricht Formation at the ENCI-HeidelbergCement Group quarry, south of Maastricht.

The 'Kunrade Limestone', generally interpreted as a lateral equivalent (nearshore facies) of the Maastricht Formation in the western part of southern Limburg, with the two units interfingering in the area around Valkenburg aan de Geul (e.g., Francken, 1947; W.M. Felder, 1975, 1977, 1978, 1990; Bless et al., 1986; W.M. Felder and Bosch, 2000), has recently been given full status as a formation (http://ncs.naturalsciences.be). Ever since the 1850s, correlation between these two units had remained a matter of debate, until P.J. Felder and Bless (1989) restudied two dozens of sections in the Kunrade area and subdivided the sequence ecostratigraphically into five bioclast zones, numbered I to V (Fig. 2). Their ecozones I to III are of Santonian–Campanian age and correlate with the Aken, Vaals and lower Gulpen formations, while ecozones IV and V comprise the 'Kunrade Limestone' proper (now Kunrade Formation), of late Maastrichtian age. P.J. Felder and Bless (1989, figs 2–3) assigned 'classic' outcrops in the Kunrade area, such as Kunderberg, Bergseweg, the 'road behind Schunck' and Putberg to their ecozone V, while the temporary outcrop along motorway 76 at Benzenrade was considered to be slightly older, corresponding to the upper part of ecozoneIV and the basal portion of ecozone V. The main fossil groups used by P.J. Felder and Bless (1989, figs 5–9) to correlate the Kunrade Limestone proper with the biocalcarenites of the upper Gulpen and lower Maastricht formations at Maastricht (borehole Kastanjelaan) and Valkenburg aan de Geul (borehole Thermae 2000) were ostracods, sabellid and serpulid polychaete worms and

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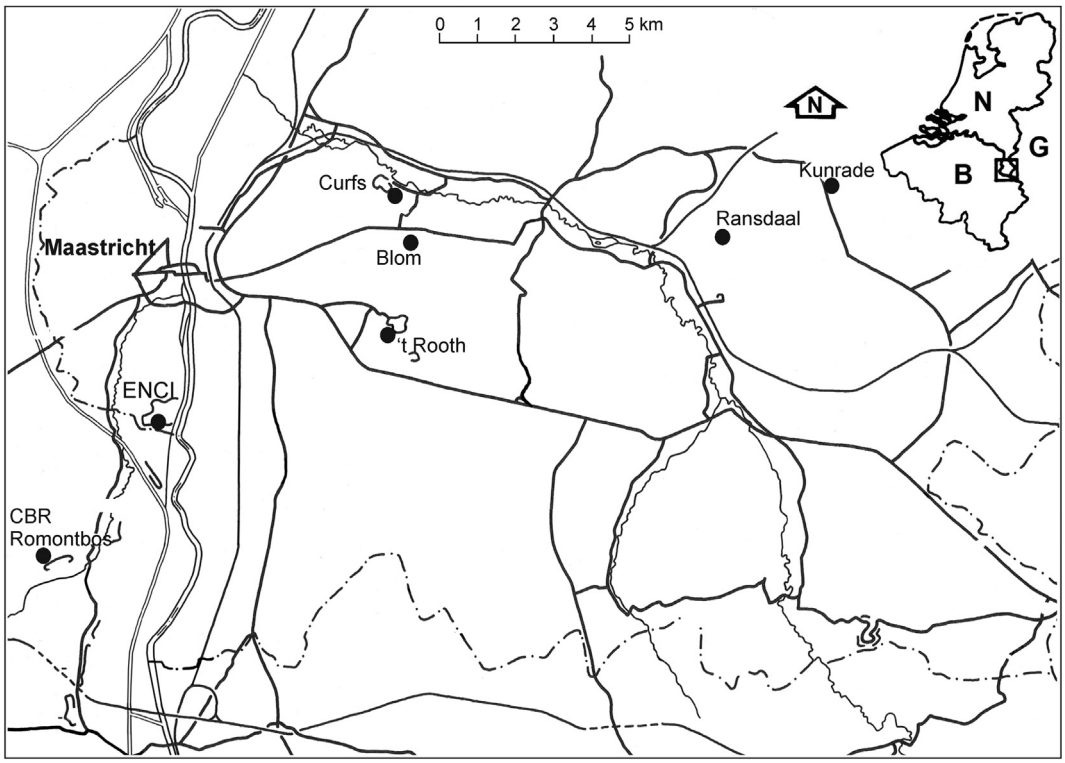

Fig. 1. Map of southern Limburg and contiguous areas in northeast Belgium and the Aachen area, Germany (modified from Kennedy, 1987, fig. 2), with localities referred to in the text.

octocorals. Those authors concluded that the lower half of the Kunrade Limestone (i.e., ecozone IV) could be equated with benthic foraminifer zone F of Hofker (1966), i.e., the Lanaye Member of the Gulpen Formation, whereas the upper half (ecozone V) corresponded to the top of Hofker's zone H, with the 'Koraalbank van Kunrade' matching the Romontbos Horizon (basal Emael Member) in the Maastricht area. A temporary outcrop near Ransdaal (see Fig. 1) that has lately been sampled extensively by three members of the Nederlandse Geologische Vereniging/afdeling Limburg (Math van Es, Dirk Eysermans and Jacques Severijns), promises to become a key section for detailed correlation between both formations. An account on the invertebrate and vertebrate faunas is now in preparation.

Table 1
Ammonoid taxa from the Maastricht and Kunrade formations known to date (data from Kennedy, 1987; Jagt, 2002, 2005, 2012, pers. obs.; Kennedy and Jagt, 2003); pachydiscids, diplomoceratids and scaphitids of potential correlative value are shown in bold print; + = presence; − = absence.

	Maastricht Fm	Kunrade Fm
Saghalinites n. sp.	−	+
Brahmaites (*Brahmaites*) *brahma*	+	−
Pachydiscus* (*Pachydiscus*) *gollevillensis	+	+
Pachydiscus (*Pachydiscus*) *jacquoti jacquoti*	+	+
Pachydiscus* (*Pachydiscus*) *noetlingi	+	+
Menuites fresvillensis	+	+
Menuites terminus	+	−
Sphenodiscus binckhorsti	+	+
Nostoceras sp.	+	−
Glyptoxoceras rugatum	+	+
Glyptoxoceras sp. 1	−	+
Glyptoxoceras sp. 2	+	−
Glyptoxoceras sp. 3	+	−
Diplomoceras cylindraceum	+	+
Diplomoceras maximum	+	−
Phylloptychoceras cf. *sipho*	+	−
Baculites anceps	+	+
Baculites vertebralis	+	+
Baculites ?n. sp.	+	−
Eubaculites sp.	+	−
Eubaculites carinatus	+	−
Hoploscaphites constrictus johnjagti	+	−
Hoploscaphites felderi	+	+
Hoploscaphites pungens pungens	+	+
Hoploscaphites pungens n. subsp.	+	−
Hoploscaphites gr. *waagei/angmartussutensis*	+	−
Acanthoscaphites (?*Euroscaphites*) cf. *verneuilianus*	−	+

Fig. 1 that has lately been sampled extensively by three members of the Nederlandse Geologische Vereniging/afdeling Limburg (Math van Es, Dirk Eysermans and Jacques Severijns), promises to become a key section for detailed correlation between both formations. An account on the invertebrate and vertebrate faunas is now in preparation.

For the time being we here suggest, on the basis of the distribution of pachydiscid and scaphitid ammonoids (and backup from diplomoceratids), that also equivalents of Hofker's (1966) zone K are represented in the type area of the Kunrade Formation. Benthic foraminifer zone K corresponds to the Nekum Member of the Maastricht Formation, which is well accessible in the Sint-Pietersberg area south of Maastricht and near Eben-Emael (Bassenge, Liège, northeast Belgium).

2. Previous work

De Grossouvre (1908) described and illustrated ammonoid faunules that had been amassed since Binkhorst van den Binkhorst's 1861–1862 monograph had appeared, predominantly from the collections of the 'Musée Royal d'Histoire naturelle de Belgique' (now Institut royal des Sciences naturelles de Belgique, Brussels). On the basis of two sufficiently preserved specimens, he (p. 32, pl. 9, figs 1–2) recorded *Pachydiscus gollevillensis* from the upper Maastrichtian of Kunrade for the first time, but failed to note that *Ammonites exilis* Binkhorst van den Binkhorst, 1862 (p. 31, pl. 6, fig. 4) represented a junior synonym. Much later, Kennedy (1987, pp. 168–171) revised all originals of Binkhorst van den Binkhorst (1861–1862) and de Grossouvre (1908), listing 15 specimens of *P.* (*P.*) *gollevillensis* in the Berlin (MNB) and Brussels (IRScNB) collections, inclusive of the lectotype of *A. exilis*. Of note is that Kennedy (1987, p. 169) mentioned a single fragment in the MNB collections