Characterization of the maastricht and kunrade ‘facies’ of the late Maastrichtian to Danian Maastricht Formation in South Limburg

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Stratigraphic context

The late Maastrichtian to Danian Maastricht Formation constitutes an important aquifer in South Limburg. The Maastricht Formation has been informally subdivided into a maastricht and kunrade ‘facies’ based on the style and degree of cementation of the rocks. Little is known, however, about the (primary) characteristics and heterogeneity of both facies, including porosity and permeability, as well as their distribution. The aim of our project is to characterize the maastricht and kunrade ‘facies’ of the Maastricht Formation and their influence on the quality of South Limburg’s aquifer.

Take-home message

The maastricht ‘facies’ is coarser, more bioclastic, and contains horizons of flint nodules. The kunrade ‘facies’ is finer, less bioclastic, and contains dm thick cemented layers. Porosity is generally higher in the maastricht facies. Thus, the quality of the Maastricht Formation as an aquifer declines towards eastern South Limburg due to an increase in cementation and consequent decrease in the porosity of the rocks in that direction.

West

maastricht ‘facies’

- Figure 2: The maastricht ‘facies’ is characterized by poorly cemented fine- to coarse-grained bioclast-dominated calcarenites with flint horizons and <5% siliciclastic grains. This facies can be subdivided into a lower and an upper maastricht ‘facies’. A: Lower maastricht ‘facies’. Poorly cemented fine-grained bioclast-dominated calcarenites with flint horizons. B: Upper maastricht ‘facies’. Poorly cemented fine- to medium-grained bioclast-dominated calcarenites with fossiliferous beds.

- Figure 3: A poorly cemented brown fine-grained bioclast-dominated calcarenite with a centimetre-thick flint horizon. B: Poorly cemented brownish-orange fine-grained bioclast-bearing calcarenite. C: Poorly cemented brown bioclast-dominated calcarenite with oriented annelid tubes.

- Figure 4: The maastricht ‘facies’ is composed of 90% of bioclasts, <5% of carbonate cement, 5% clay, and <3% siliciclastic grains. The blue epoxy represents porosity. A and B: Poorly cemented fine- to medium-grained bioclast-dominated grainstone (stained with alizarin red-S and potassium ferricyanide). B: Poorly cemented fine-grained bioclast-dominated grainstone (stained with alizarin red-S and potassium ferricyanide). B: Poorly cemented fine-grained bioclast-bearing calcarenite.

East

kunrade ‘facies’

- Figure 5: The kunrade ‘facies’ is characterized by an alternation of friable and hard layers of fine- to medium-grained bioclast-bearing calcarenites without flint horizons and <5% siliciclastic grains. In the Kunrade quarry, towards the top of the section, grain size and diversity of bioclasts increase.

- Figure 6: A Lower part of the Kunrade quarry. Alternation between poorly cemented brownish-orange very fine-grained bioclast-bearing calcarenite and cemented brown fine-grained bioclast-bearing calcarenite. B: Cemented brown fine-grained bioclast-bearing calcarenite. C: Upper part of the Kunrade quarry. Contact between poorly cemented brownish-orange fine-grained bioclast-bearing calcarenite and cemented brown fine-grained bioclast-bearing calcarenite.

- Figure 7: The kunrade ‘facies’ is composed of 30% bioclasts, <50% cement, <15% clay, and <5% siliciclastic grains. The blue epoxy represents porosity. A: Poorly cemented bioclast-bearing and cement-bearing packstone. B: Poorly cemented fine-grained bioclast-bearing grainstone (stained with alizarin red-S and potassium ferricyanide). B: Poorly cemented fine-grained bioclast-bearing grainstone (stained with alizarin red-S and potassium ferricyanide). B: Poorly cemented fine-grained bioclast-bearing grainstone (stained with alizarin red-S and potassium ferricyanide).

Dolkesberg: transition between the two ‘facies’?

The outcrop of Dolkesberg is considered to be the transition between the maastricht and kunrade ‘facies’ (Figure 8A). The microfacies analysis of a more prominent layer (Figure 8B) reveals that this type of layer is poorly cemented and corresponds to the fine-grained bioclast-dominated poorly cemented grainstones of the maastricht ‘facies’. As the kunrade ‘facies’ is not present, the outcrop of Dolkesberg cannot be considered the transition between the two facies.

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