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Karst in the Netherlands

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Abstract
98 % of the Netherlands consist of quatemary sediments such as sand, clay and peat. In two small areas, however, we find older rocks and even some karst: the Winterswijk area with Muschelkalk (Triassic) and the southem part of Dutch Limburg with cretaceous chalk. Some lapiés were found (and destroyed) during quarrying activities in Winterswijk, but in Limburg a relatively large area with interesting karst phenomena still exists, threatened as well. The karst area comprises 160 km of underground quarries, dolines, geological "organ pipes" and some natural passages or caves (with a length of 70 m).

Résumé
98 % des Pays-Bas sont constitués de sédiments quaternaires tels que sable, argile et tourbe. Dans deux petites régions, cependant, il existe des roches plus anciennes et même un peu de karst: la région de Winterswijk, avec du Muschelkalk (Trias) et la partie sud du Limbourg hollandais, avec de la craie crétacée. Quelques lapiés ont été découverts (et détruits) dans des carrières de Winterswijk, mais au Limbourg un périmètre relativement étendu comprend toujours des phénomènes karstiques intéressants, menacés eux aussi.
La région karstique compte 160 km d'excavations souterraines, des dolines, des "tuyaux d'orgues" et quelques conduits naturels ou grottes (d'une longueur de 70 m).

I. INTRODUCTION

98% of the Netherlands consist of pleistocene and holocene sediments: gravel, sand, clay and bog. A large part is formed by "polders" or diked land. In two rather small areas we find older rocks and even some karst: the area around Winterswijk, and the southern part of the province of Limburg (Fig. 1).

H. WINTERSWIJK AREA

Near Winterswijk is a large triassic Muschelkalk limestone quarry. Here, in 1942, an area of about 500 square metres of karren or lapiés was discovered when the top soil of pleistocene clays was removed.

Unfortunately this layer could not be preserved, because the limestone was quarried away. No limestone pavements were ever discovered here again (CROMMELIN, 1943; OESTREICH, 1943; DE SWART & VAN DER PAS, 1989).

III. SOUTHERN LIMBURG

In the most southern part of the Netherlands, the province of Limburg consists, for the most part, of cretaceous "mari" - rather chalk in fact, for it contains sometimes only 2% of clay (VAN SCHAIK, 1938; RUTTEN, 1945; VANWIJNGAARDEN, 1967; SMITSHUYSEN, 1967; DE SWART & VAN DER PAS, 1989). It is rather soft and can thereby be quarried away easily. This has been done since Roman times, in large underground quarries. In the area, these underground quarries are called "marl caves" - in fact a twice wrong name. The limestone was until very recently used, as stone blocks, for building purposes, in cernent industry, and for "improving" acid agricultural fields. In that way large underground systems were formed, with long rectangular passages. More or less large rooms arise where these galleries meet. Pillars have to be left for the sake of supporting the ceiling. The underground systems are rather complex. The so-called Sint Pietersberg caves (Fig. 2) are about 100 km long, and in the whole area there are about 170 of these artificial caves, with a total length of 160 km.

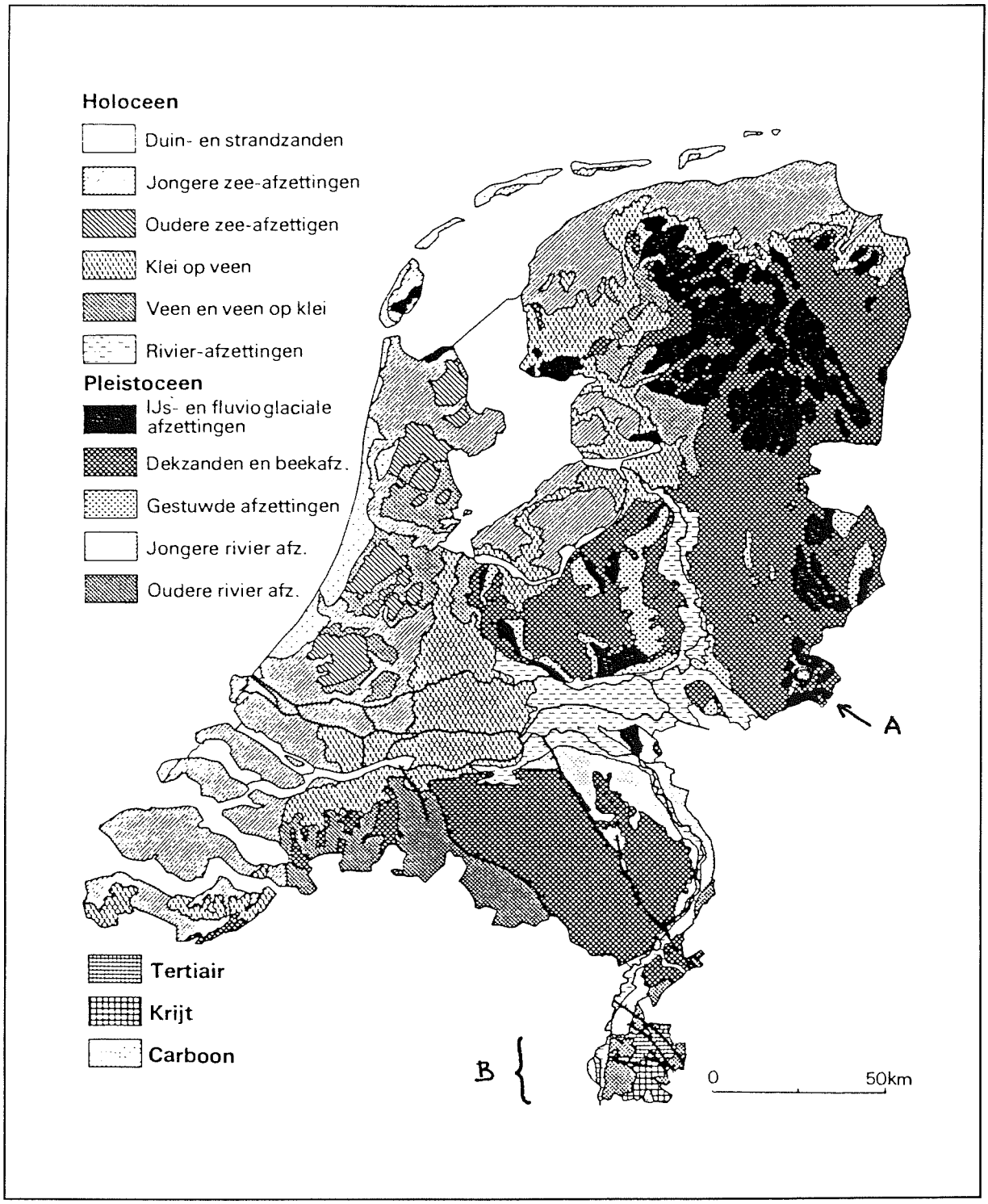

Figure 1 : Simplified geological map of the Netherlands.
A: Winterswijk
B: "marl" area of southern Limburg

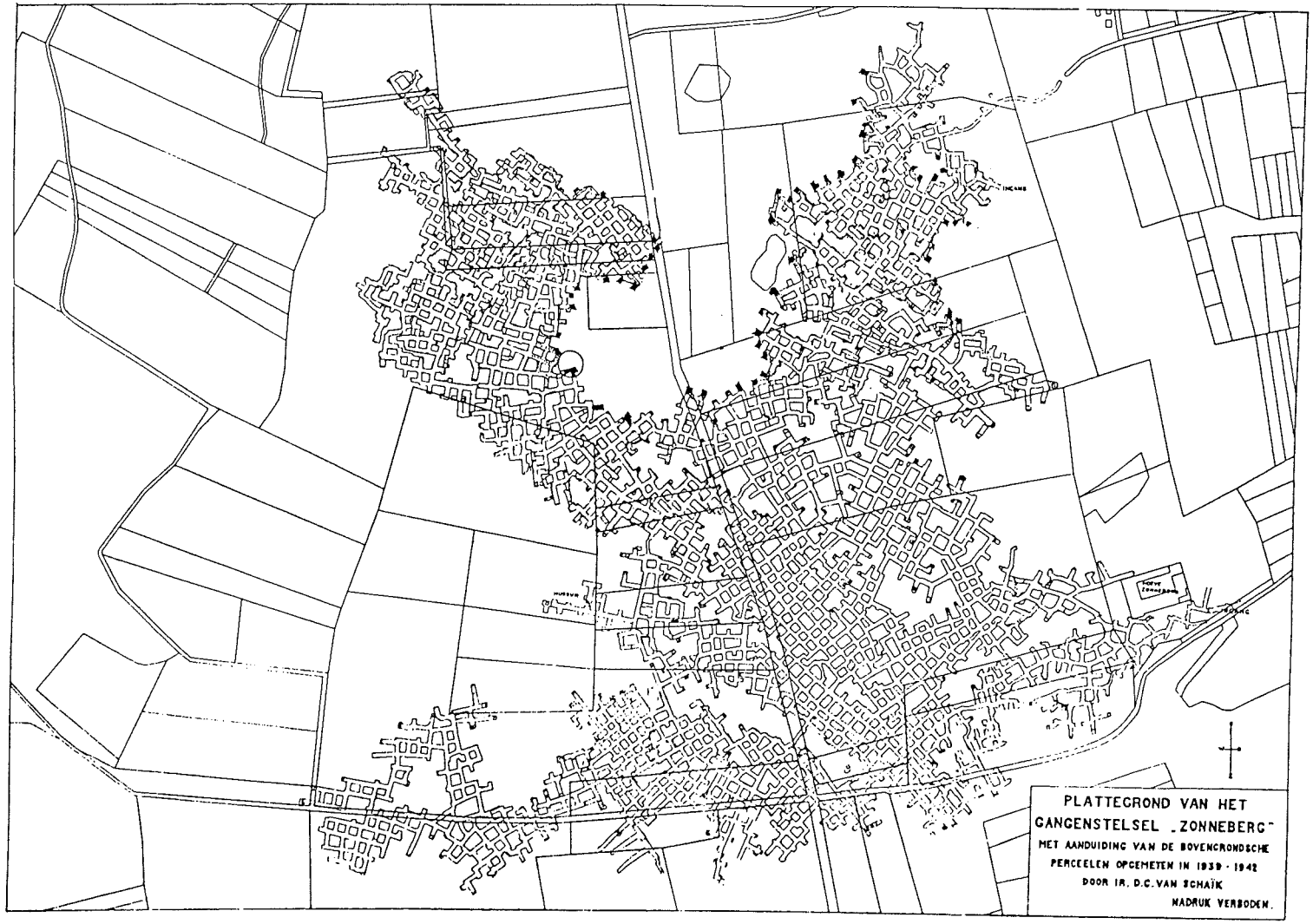

Figure 2 : Part of Sint Pietersberg "caves" (so-called Zonneberg System) showing very well the complexity of the underground quarries (width of map about 1 km)

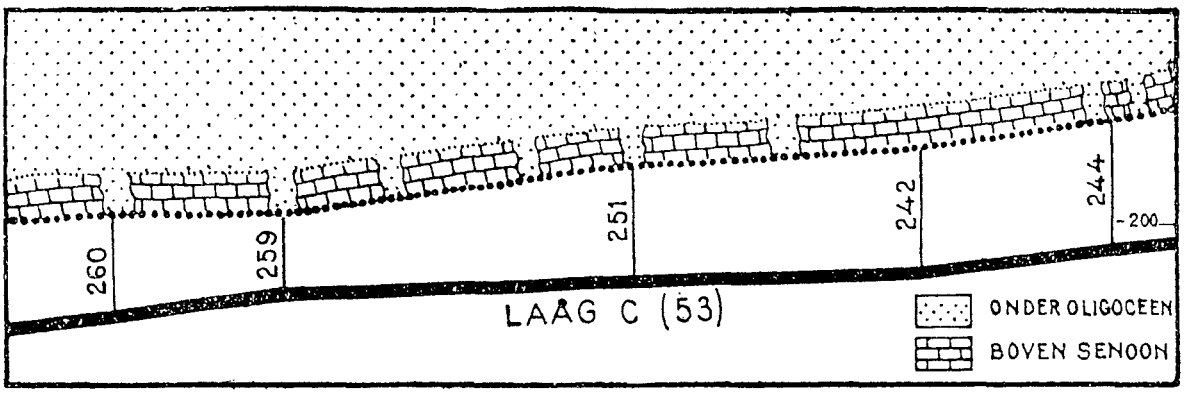

Figure 3 : Profile of upward drilling in the Hendrik coal mine

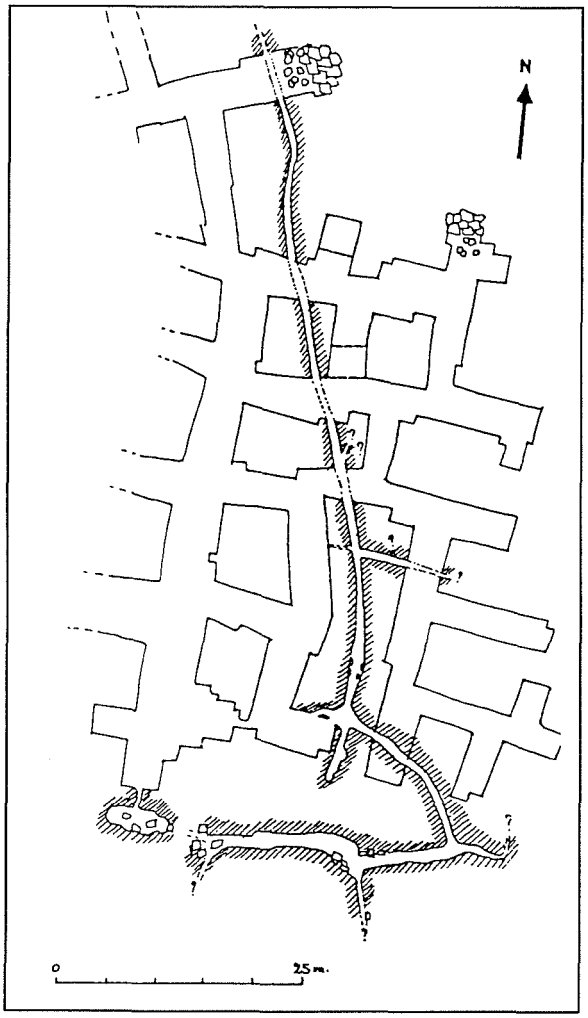

Figure 4 : Natural (karst) gallery in Sint Pietersberg caves

The caves are of importance :

(1) rince many centuries, the caves were visited by all kind of people. These visitors left their pictures and texts, sometimes dated, on the walls. These markings nowadays form the object of thorough historical investigation.

(2) also for biospeleologists the caves form a large and interesting area of research. Although no troglobionts are found, large number of other cave dwelling animais can be studied. For example, 12 out of 19 species of bats familiar in Holland roost or hibernate here in these artificial caves, because, like in "normal" caves, the climatic conditions here are very stable.

(3) these underground areas form also a pleasant exercise- and playground for Dutch cavers.

In this limestone area, three forms of natural karst phenomena can be seen :

(1) "geological organ pipes": filled in karst pits, dolines or sink holes, several tens of metres deep, and sometimes with a shown connection with the subterranean galleries.

An interesting example of karst research related to these "organ pipes" is shown in Fig. 3. The drawing shows a profile of upward drilling from a gallery in a former Dutch coal mine, the "Hendrik", at a depth of between 150 and 200 metres. The coal itself is carboniferous, and has a senonian (thus creataceous) chalk cover.

But, while drilling, the Cretaceous appeared to be missing in some spots. There the drillers met immediately the younger, oligocene, glauconite or green sands. Also the hydrology of the covering layers was

disturbed. This phenomena seemed to be caused by the (palaeo) karstic organ pipes.

(2) on the surface, we find out dolines.

(3) underground, we find out natural cave passages (Fig. 4), sometimes partially filled in, and also accessible natural spaces, although not very large in diameter. The longent natural cave passage known at the moment has a length of 70 metres.

They are not well studied until now, but they probably originated where a fault and a beddingplane intersect (through mixing corrosion, perhaps), and their height increased because of repeatedly collapse of the ceiling. The floor, therefore, is always composed of a thick layer of loose, sandlike, limestone particles. A solid floor is not yet found.

Frequently, the karst passages interconnect with the artifical galleries, and that is the way they were discovered. Outside, in the open air, no signs of natural caves were found until now.

There is a lot of natural breakdown in the underground quarries. This makes the underground quarries very unstable in some places , and therefore dangerous. There is also a very real danger of getting lost in these complex systems. As a consequence, it is difficult to get permission to enter them. Some safe parts, however, can be visited with a guide, like a show cave.

The greatest threat to the underground systems, with all their biological, geological and historical values, are the limestone quarries.

IV. DISCUSSION:

Prof. Panos: While visiting these artificial caves near Maastricht, I noticed there was nearly no ventilation, so there might be a Radon related problem. Has there been done any research concerning Radon ?
Answer: To my knowledge, no.

V. REFERENCES

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