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# The pioneer snail fauna of a rehabilitated limestone quarry near Maastricht, The Netherlands

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## INTRODUCTION

In the very south of the Netherlands the subsoil consists of Cretaceous limestone. In this area, near the town of Maastricht, lies the Sint Pietersberg (Mount St. Peter). This hill, 110 m above sea level, has been well-known to naturalists ever since the discovery of a fossil skull of *Mosasaurus hoffmanni* in 1770 (see Faujas-Saint-Fond, year 7 of the French Republic = 1798 or 1799, and Hamoir, 1980, 1981), and more recently for its exceptional flora and fauna (see Van Schaïk, 1983). Unfortunately the St. Pietersberg is subject to excavation to obtain the main raw material for the production of cement. This will finally result in an open quarry of about 125 hectares (310 acres). For the quarry a plan of rehabilitation was developed (Vallen, 1972); by 1978 such a large part of the hill had been dug off that in the period 1978-1979 the first part of the quarry could be rehabilitated. In 1984 this part of the quarry was examined for the occurrence of snails.

## DESCRIPTION OF THE LOCALITIES EXAMINED

The quarry was rehabilitated by bringing back the earth and gravel that formerly covered the limestone; in addition silex was used. In this way inside the quarry slopes were created that were intentionally sown with herbs. Three localities on these slopes were examined for the occurrence of snails (fig. 1).

Two of the localities (1 and 2) are situated on a slope facing north. Loc. 1 is situated higher on the slope than loc. 2. Both localities were covered with a herb layer of up to about 1.5-2.0 m high. The rather undifferentiated vegetation comprised only a small number of species, primarily *Melilotus albus* and *Artemisia vulgaris*. The soil at loc. 1 is, except when rain is draining off, dry or very dry; only locally clay may hold some water. At loc. 2 the soil is dry and stony.

Loc. 3 is situated on a slope facing south to south-east. On this slope some (at the time of examination small) trees were planted (including *Alnus glutinosa, Quercus robur* and *Rhamnus fragula*). The ground is stony and covered intermittently with a low herb layer with species such as *Trifolium repens, Erigeron canadensis, Medicago lupulina, Senecio viscosus* and *Lactuca serriola*. This vegetation is indicative for a warm, dry and stony substrate.

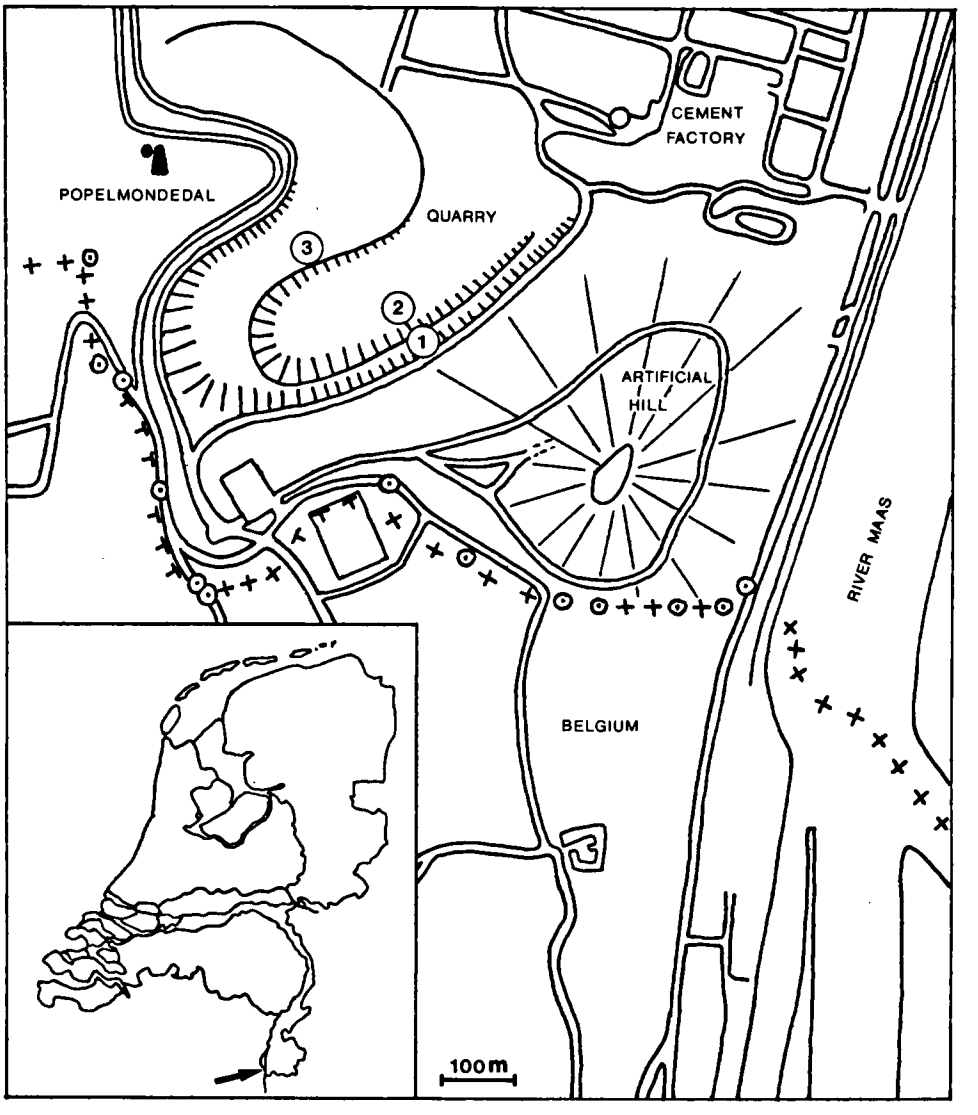


Fig. 1. Detail of the rehabilitated part of the limestone quarry at Maastricht. Localities in the quarry examined for the occurrence of snails are numbered 1-3. Inset. — Map of the Netherlands; the arrow indicates the location of the quarry.

## MATERIALS AND METHODS

In order to collect snails both authors examined each locality for half an hour with the naked eye. Moreover, soil samples were taken (about 2 liters per location) which were sieved afterwards. The smallest sieve-width used was 0.3 mm.

Since the same sampling procedure was employed at all localities, the quantitative data of the three locations are mutually comparable. Snails collected were identified using the mollusc handbooks of Gittenberger, Backhuys & Ripken (1984) and of Adam (1960).

## RESULTS

Only those species represented by living animals or fresh shells have been listed in table 1. In addition one old shell of *Sphyradium doliolum* (that may have come with the soil that now constitutes the slopes) was found at loc. 2.

Taking all localities together, ten species were found which were represented by living or fresh specimens. Four of these, namely *Cochlicopa lubricella, Vallonia excentrica, Candidula intersecta* and *Helicella itala* prefer a dry habitat (Gittenberger et al., 1984). All other species may also be found in different habitats. The finding of one specimen of *Zonitoides nitidus* was somewhat of a surprise; this species prefers a wet habitat.

At locs. 1 and 2 *Candidula intersecta* and *Trichia hispida* are the dominant species. This is true for loc. 3 as well, but here *Helicella itala* is also very common. This latter species is almost absent from locs. 1 and 2.

## DISCUSSION

This investigation reveals that the snail fauna of a rehabilitated part of the large St. Pietersberg limestone quarry comprises a rather small number of species. Of two out of the ten species found (*Punctum pygmaeum* and *Zonitoides nitidus*) only one specimen was collected. This has to be considered insufficient evidence that these species live in the quarry. Rather, casual transport of single specimens from other localities may be responsible. This is accentuated by the finding of *Zonitoides nitidus*, a species that prefers

| Species collected | Localities | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| *Cochlicopa lubricella* (Porro, 1838) | - | 8 | - |
| *Vallonia costata* (Müller, 1774) | 19 | 8 | 6 |
| *Vallonia excentrica* Sterki, 1893 | 1 | - | 3 |
| *Punctum pygmaeum* (Draparnaud, 1801) | - | 1 | - |
| *Vitrina pellucida* (Müller, 1774) | 12 | 12 | 2 |
| *Oxychilus draparnaudi* (Beck, 1837) | 5 | 2 | - |
| *Zonitoides nitidus* (Müller, 1774) | - | 1 | - |
| *Candidula intersecta* (Poiret, 1801) | 102 | 33 | 43 |
| *Helicella itala* (L., 1758) | - | 3 | 126 |
| *Trichia hispida* (L., 1758) | 132 | 411 | 32 |

Table 1. Numbers of individuals of snail species collected in three localities in the limestone quarry in the St. Pietersberg. Description of the localities is given in the text.

wet conditions. To our knowledge this species lives along the borders of the river Maas which flows within 1.0 km of the quarry (see fig. 1). For the eight other species we conclude that these are inhabitants of the quarry. All species that are more or less stenotopic prefer a dry habitat (see sub Results). A clear difference was noted between north- (locs. 1 and 2) and south-facing (loc. 3) slopes. On the latter, in contrast to the former two, *Helicella itala* was present in large numbers. This difference may be a consequence of the fact that this slope is warmer and less shaded (bare soil or low herbs) than the north-facing slope.

The small number of species in this rehabilitated quarry becomes evident when the results are compared with the snail fauna described for the chalk grasslands of the St. Pietersberg (18 species, table 2; Lever & Majoor, 1985). Chalk grasslands are the original herb vegetation of large parts of the non-manipulated slopes of the hill. Due to current changes in administration, only a few small remnants of these grasslands have been conserved.

The presence of large numbers of *Candidula intersecta* in the quarry is interesting since elsewhere in the Netherlands this species is known only from the immediate vicinity of the North Sea coast (Gittenberger et al., 1984). During an investigation of the malacofauna of the St. Pietersberg in the period 1949-1952 this species was found on the hill for the first time (Altena, 1958). In the Rijksmuseum van Natuurlijke Historie at Leiden two specimens collected during this period (August 20, 1950, and January 10,

| Species collected | Habitats | |
|---|---|---|
| | Chalk grasslands | Quarry |
| *Cochlicopa lubricella* (Porro, 1838) | + | + |
| *Truncatellina cylindrica* (Férussac, 1807) | + | - |
| *Vertigo pygmaea* (Draparnaud, 1801) | + | - |
| *Sphyradium doliolum* (Bruguière, 1792) | + | - |
| *Pupilla muscorum* (L., 1758) | + | - |
| *Vallonia costata* (Müller, 1774) | + | + |
| *Vallonia excentrica* Sterki, 1893 | + | + |
| *Punctum pygmaeum* (Draparnaud, 1801) | + | - |
| *Vitrina pellucida* (Müller, 1774) | + | + |
| *Nesovitrea hammonis* (Ström, 1765) | + | - |
| *Aegopinella pura* (Alder, 1830) | + | - |
| *Aegopinella nitidula* (Draparnaud, 1805) | + | - |
| *Oxychilus draparnaudi* (Beck, 1837) | + | + |
| *Cecilioides acicula* (Müller, 1774) | + | - |
| *Clausilia bidentata* (Ström, 1765) | + | - |
| *Candidula intersecta* (Poiret, 1801) | - | + |
| *Helicella itala* (L., 1758) | + | + |
| *Trichia hispida* (L., 1758) | + | + |
| *Helix pomatia* L., 1758 | + | - |
| Total number of species | 18 | 8 |

Table 2. Snail species of the chalk grasslands of the St. Pietersberg (Popelmondedal and Kannerhei) and the rehabilitated part of the quarry. Data for chalk grasslands are taken from Lever & Majoor (1985).

1951) are present (A.J. de Winter, personal communication). Recently the authors found specimens of *Candidula intersecta* only rarely outside the quarry (Lever & Majoor, in preparation). The abundance of this species inside the quarry is in agreement with the supposition of Altena (1958) that this species prefers ruderal areas. According to this view it is possible that it is the very excavation of the hill that has permitted *Candidula intersecta* to settle here.

Since the vegetation of the rehabilitated part of the quarry may be considered a pioneer vegetation, we by analogy propose to refer to the snail fauna of this area as a pioneer fauna of such dry biotopes. Indicative for the pioneer character of both flora and snail fauna in the quarry is the occurrence of relatively small numbers of species often represented by large populations. In contrast, small old chalk grasslands on the same hill harbour more plant (Willems & Blanckenborg, 1975) and mollusc species (table 2; Lever & Majoor, 1985; De Winter, 1985).

The species composition of the snail fauna of the quarry is probably determined in part by the species that live in its vicinity. There are at least three ways in which new species could reach this quarry: (a) by transport along with earth and gravel used to construct the slopes, (b) by infiltration from surrounding areas, and (c) by transportation by larger animals, i.e. birds (Brandes, 1951; Williamson, Parslow & Dance, 1959). The finding of single specimens of *Punctum pymaeum* and *Zonitoides nitidus* may represent examples of the latter transport mechanism. In addition to active or passive transportation facilities (micro-)climatological circumstances probably have been a major factor in determining the species composition of the snail fauna of the quarry.

The description of the snail fauna presented in this paper is in fact only a snapshot of a continuous process of succession. It will be most interesting to re-examine this area in the future to follow this evolution since data on succession of snail faunas in any habitat are scarce (see, e.g. Reinink, 1979).

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## SUMMARY

The snail fauna of a limestone quarry rehabilitated five years earlier was found to encompass eight species only. On a slope in the quarry facing north the fauna was quantitatively strongly dominated by *Trichia hispida* and *Candidula intersecta*, on a slope facing south-east in addition by *Helicella itala*. The paucity of snail species in the quarry markedly contrasted with the snail fauna of some old chalk grasslands in the vicinity of the quarry where 18 species of snails were collected. Based on these characteristics, and the fact that *Candidula intersecta* is rare in the Netherlands except for this quarry and some localities near the North Sea coast, the snail fauna of the limestone quarry is presented as an example of a pioneer snail fauna of dry, chalk-rich biotopes.

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## SAMENVATTING

De pionier-huisjesslakken-fauna van het heringerichte deel van een mergelgroeve bij Maastricht

De Sint Pietersberg ten zuiden van Maastricht bestaat uit een krijtachtig gesteente bekend onder de naam mergel. Deze voor Nederland bijzondere ondergrond heeft aanvankelijk tot de ontwikkeling van een buitengewone flora en fauna op de berg geleid. Helaas wordt het plateau van de berg grotendeels afgegraven ten behoeve van de cementindustrie, waardoor uiteindelijk een open groeve met een oppervlakte van ca. 125 ha zal ontstaan. In 1978 was de afgraving van het meest zuidelijke deel van de groeve voltooid en werd een begin gemaakt met de herinrichting van de groeve volgens een in 1972 opgesteld landschapsplan. Hiertoe werd materiaal van de oorspronkelijke deklaag (bestaande uit o.a. leem en kiezel) alsmede silex op de hellingen aangebracht. Er werden wilde planten ingezaaid en jonge boompjes geplant.

Vanaf 1979 heeft dit deel van de groeve zich verder ongestoord als biotoop kunnen ontwikkelen. In 1984 werden door ons op drie vindplaatsen in de groeve (twee op de noordhelling en één op de zuidoosthelling) telkens gedurende een half uur slakkenhuizen verzameld. Tevens werden van elke lokatie grondmonsters (elk ca. 2 l) meegenomen waaruit door zeven de slakkenhuizen werden gescheiden.

In totaal werden op deze drie vindplaatsen slechts huisjes van acht soorten slakken in twee of meer exemplaren aangetroffen. Op de noordhelling in de groeve werd de slakkenfauna kwantitatief sterk gedomineerd door *Trichia hispida* en *Candidula intersecta*; op de zuidoosthelling was bovendien *Helicella itala* in grote aantallen vertegenwoordigd. De samenstelling van de slakkenfauna van de groeve wijkt sterk af van die van een aantal oude kalkgraslandjes op de hellingen van de Sint Pietersberg in de direkte omgeving van de groeve. Op deze kalkgraslandjes bleken in totaal 18 soorten huisjesslakken voor te komen waarvan 16 algemeen. Gelet op de afwijkende samenstelling van de huisjesslakken-fauna in de groeve en het feit dat *Candidula intersecta* behalve in deze groeve en langs de Noordzeekust zeldzaam is in Nederland, wordt de huisjesslakkenfauna van de heringerichte mergelgroeve beschouwd als een voorbeeld van een pionier-slakkenfauna van droge, kalkrijke biotopen.