

Contribution to the knowledge of the groundwater communities from northern Morocco

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Abstract

The groundwater fauna from the Rif region, in northern Morocco, is highly diversified. Several stygobite taxa are new for science: oligochaetes (species of *Trichodrilus*, genus and species of Phallophila), gastropods (new species of *Hadziella*, *Heideella*, *Pseudoislamia* and *Belgrandia*), amphipods (ten new species of *Pseudoniphargus*), and isopods (*Microcharon alaniae* has been recently described). Some taxa are reported for the first time from Morocco, i.e. the oligochaetes Phallophila, as well as the crustacean *Metastenasellus* sp. (isopod). As in other Moroccan regions already investigated, the distribution of groundwater communities, especially peracarid crustaceans, is strongly related to water quality, substrate grain size and the local palaeogeography. The latter factor provides an understanding of the observed community differences both between sites and with other Moroccan regions.

Introduction

The Moroccan groundwater fauna was still poorly known until the beginning of the eighties (CHAPPUIS, 1953; BALAZUC & RUFFO, 1953; KARAMAN & PESCE, 1980; PESCE *et al.*, 1981). More systematic stygobiological investigations were recently performed, first in the Marrakesh region, then in other parts of Morocco: Goulmima (BENAZZOUZ, 1983), Tiznit (BOULAL, 1988), Guelmim (IDBENNACER, 1990), El Jadida (FAKHER EL ABIARI, 1999) and the Rifian region. These last sampling were performed with the aim of both making more complete the inventory of known stygobiotic taxa from Morocco and testing once more the possible relationships between the biodiversity of the subterranean aquatic fauna and groundwater quality. This paper finally presents the first data on the Rifian stygobiotic fauna.

Study area and methods

The Rifian domain is the Moroccan part of the Betico-Rifian arc which is the western end of the Alpine ranges in the Mediterranean Basin (FRIZON DE LA MOTTE *et al.*, 1991). It is formed by several alpine nappes including three main structural units: the Sebides which are the deepest ones, with a base of peridotites, then the Ghomarides which are of Paleozoic, Triassic, Liasic and Eocene age, and finally the Rifian range formed by a pile of folds and small carbonated nappes of the upper Trias and lower Lias periods.

Three sampling campaigns were successively performed in the region. More than sixty wells and ten or so springs were prospected within a range of 300 km, extending from the Atlantic Ocean to the Algerian Boarder (fig.1).

The fauna of wells was generally collected using a phreatobiological net similar to the Cvetkov model, and baited traps, a more efficient method for capturing crawling species (BOUTIN & BOULANOUAR, 1983). These two methods were completed, when possible, by filtering through a plancton net the water extracted by motorized pumps. The fauna of springs was sampled with a net settled at the source when stringing the sediments just upstream from the water emergence (MESSOULI, 1994).

Results

More than 76 taxa were sampled, including 14 species of Oligochaeta, 12 species of Gastropoda and 42 species of Crustacea. The specific richness of the region stygofauna reaches 38 species (representing about 50% of the total community). The most common representatives of the stygofauna are the gastropods (eight species) and the crustaceans (26 species including eight copepods, three ostracods and 15 peracarid and syncarid crustaceans (tab.1).

This global biodiversity is roughly similar to that of other regions of Morocco previously investigated, as 50 species were collected in the Tiznit region (BOULAL, 1988), 38 taxa in the Marrakesh area (BOULANOUAR, 1995) and 59 species in the Guelmim wells, South-West of the Moroccan Anti Atlas (BOUTIN & IDBENNACER, 1989). The Rifian subterranean fauna seems enough diversified when compared with that of Europe and North America

(BOTOSANEANU, 1986; JUBERTHIE & DECU, 1994; GIBERT *et al.*, 1994), especially when considering the hydrobiid snails and the peracarid crustaceans.

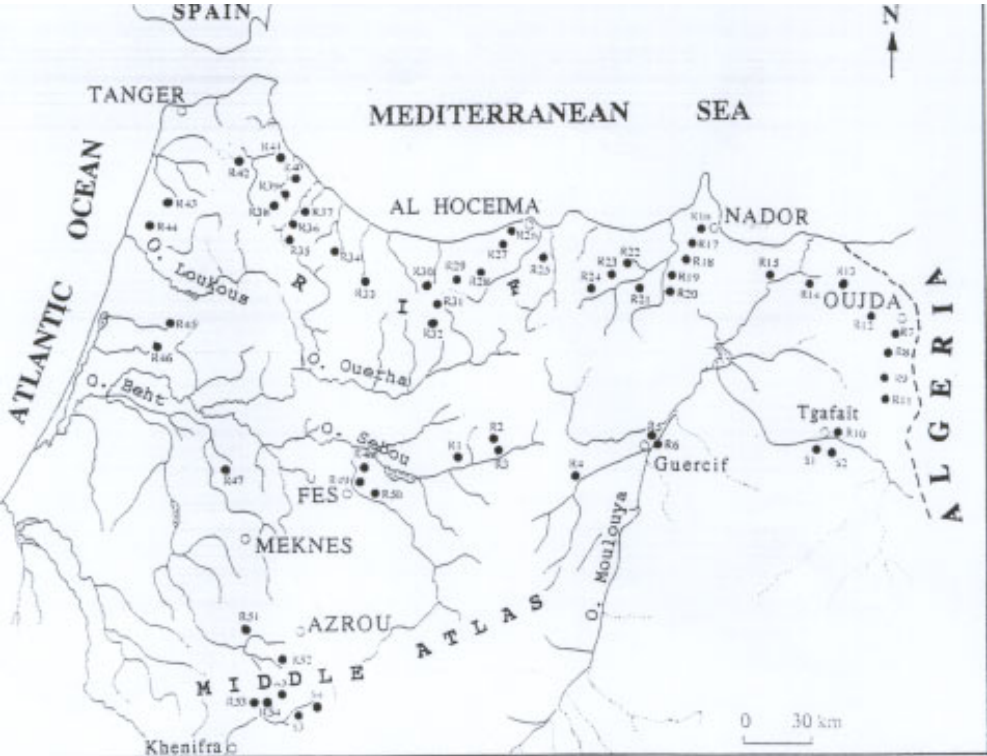


Figure 1 - Location of the study sites, wells (R) and springs (S), in the Rifian region of Morocco

The Rifian stygofauna is also characterized by a good number of species new for science and by a high rate of endemic species. Five new species of gastropods were collected, including two species also sampled subsequently in the Beni Mellal plain and three species considered as endemic of the Rif, *Giustia rifensis*, *Heideella knidirii* and *Pseudoislamia yacoubii*. Similarly a new endemic genus of Oligochaeta is a representative of the subfamily Phallodrilinae, with a distribution area limited to the North Eastern part of the Rif. Within the crustaceans several endemic species recently collected are still under study. It is the case of three different species of the amphipod *Pseudoniphargus*, of one species of the syncarid *Iberobathynella*, of one species of the stenassellid isopod *Metastenasellus*, and of 3 new cirolanid isopods which include two different species of *Typhlocirolana* and a new genus which will be published as *Rifolana* n.gen. At last one species of the Rifian isopod Microparasellidae was recently described as *Microcharon alamaie* (BOULANOUAR *et al.*, 1997).

From the consideration of this faunistical list some biogeographical remarks are possible. The Oligochaeta Phallodrilinae belong to a marine group and are mentioned for the first time from fresh groundwaters in the Rifian region; it may be considered as a new evidence of the marine origin of a great part of the stygofauna. The occurrence of this representative in the Rif is certainly related to the origin of the Rifian block, derived from the complex Mesozoic and Cenozoic history of the Alboran plate, which emerged and split in the Mediterranean in a number of blocks which subsequently drifted to North African and Iberian plates. In other respects, the occurrence of species of the amphipod *Metacrangonyx* in this septentrional region is of great biogeographical interest as it extends widely the distribution of a family only known in Morocco from the south of the Idrissid Land.

The amphipods *Pseudoniphargus* now appear as a large group of species occurring also inside the Rifian domain and not only on its southern margin where it was first discovered. Its origin is certainly related (as that of the phreolodrilid Oligochaeta) with the history of the Rifian block, especially with the late Tortonian and early Messinian closure of the South-Rifian Channel and the marine transgressions and regressions in the Rifian domain, when the Rifian block collided with the African plate (COINEAU & BOUTIN, 1996, FAKHER *et al.*, 1999). Other Rifian thalassoid stygobiontic groups have representatives in other parts of Morocco, South of the Idrissid Land, and seem related to transgressions and regressions of the Cenomano-Turonian and of the Senonian or Eocene.

Table 1 - List of the aquatic subterranean species in the Rifian region (* : stygobites species, ° : stygophiles species)

Taxa	Taxa	Taxa
Foraminifera	Copepoda	Amphipoda

<i>Ammonia tepida</i> °	<i>Acanthocyclops sp.*</i>	<i>Salentinella sp.*</i>
Oligochaeta	<i>Diacyclops dubbocki</i> °	<i>Pseudoniphargus ruffoi*</i>
<i>Rhyacodrilus sp.</i> °	<i>Diacyclops sp.*</i>	<i>Pseudoniphargus sp.*</i>
<i>Phallogdrilinae n.g, sp.*</i>	<i>Megacyclops viridis</i> °	<i>Pseudoniphargus sp.1*</i>
<i>Trichodrilus sp.*</i>	<i>Metacyclops subdolanus*</i>	<i>Pseudoniphargus sp.2*</i>
Gastropoda	<i>Paracyclops imminutus</i> °	<i>Pseudoniphargus sp.3*</i>
<i>Hadziella midarensis*</i>	<i>Paracyclops fimbriatus</i> °	<i>Maghrebidiella sp.*</i>
<i>Heideella knidrii*</i>	<i>Tropocyclops prasinus</i> °	<i>Metacrangonyx sp.*</i>
<i>Heideella andrea*</i>	Ostracoda	Isopoda
<i>Belgrandia sp.</i> °	<i>Pseudocandona albicans</i> °	<i>Proasellus coxalis africanus</i> °
<i>Pseudoislamia rifensis*</i>	<i>Fabaeformiscandona sp1*</i>	<i>Microcharon alamaie*</i>
<i>Mercuria similis</i> °	<i>Fabaeformiscandona sp2</i> °	<i>Typhlocirolana haouzensis aff*</i>
<i>Giustia rifensis*</i>	Syncarida	<i>Typhlocirolana sp.*</i>
<i>Pseudoislamia yacoubii*</i>	<i>Iberobathynella sp.*</i>	<i>Rifolana n.g. sp.*</i>
		<i>Metastenasellus sp.*</i>

Conclusion

The Rifian groundwaters are inhabited by a relatively rich stygobiontic fauna including a number of taxa related to the ancient Mesozoic history of the Rifian block, like in other parts of Morocco, but also by original and generally endemic other taxa related to the more recent Cenozoic history of the Rifian domain. A number of these species, as they were recently collected, are still under study. Before performing a more detailed analysis of the comparative biodiversity of sampled sites, the first results show that the species richness, especially that of stygobionts, is clearly linked with groundwater quality as in other regions of Morocco.

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