

ORIGIN OF THE NON-MARINE AQUATIC CRUSTACEAN FAUNA OF SAINT HELENA AND ASCENSION

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With 1 table

ABSTRACT. The poor biodiversity in stygobiont and epigeal crustaceans on Saint Helena and Ascension, in the southern Mid-Atlantic contrasts sharply with the more diversified fauna of the Canary and Madeira archipelagoes, the more northern Mid-Atlantic islands. This may be explained by the paleohistory of these islands.

Recent expeditions of members of our team to two isolated islands, Ascension and Saint Helena (STOCK & VONK, 1989; STOCK, 1995b) in the southern Mid-Atlantic, have shed new light on the evolutionary history of the non-marine crustaceans of these islands. Both islands share some of the same geophysical and climatological traits (high altitude, volcanic origin, tropical regime), but estimates are that St. Helena may be some 10 times older than Ascension. Nevertheless, in biodiversity is surprisingly low on *both* islands, and a factor 10 lower than that of Madeira or the Canary islands.

In this paper, I will try to explain the low biodiversity in terms of the geological, in particular plate tectonic, history of the region.

It is nowadays generally accepted that the non-marine aquatic fauna of the Mid-Atlantic islands originates for a large part from marine ancestors (a so-called thalassoid origin). Typical freshwater animals, like primary freshwater fishes, Bathynellacea or asellid isopods are lacking, or when they are present, they have been introduced in historical times, by purpose or accidentally (this is for instance the case in the isopod *Asellus aquaticus* in Madeira; HENRY et al., 1994).

The thalassoids descend from marine ancestors, in geological time. They still do have close relatives in salt water elsewhere in the world, often even belonging to the same genera, though not to the same species. Examples of such animals on the Mid-Atlantic islands are:

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- the amphipod crustaceans *Pseudoniphargus* (on the Azores, Madeira, and the Canarias; STOCK & ABREU, 1994), *Rhipidogammarus* and *Chaetogammarus* (Canarias; BEYER & STOCK, 1994), *Spelaeonicippe* (Canarias; STOCK & VERMEULEN, 1982), *Sarothrogammarus* (Madeira and the Azores; STOCK, 1995c); *Psammogammarus* (Canarias and Cape Verdians; STOCK & SÁNCHEZ, 1987; VONK & STOCK, 1988; VONK, 1990), *Metacrangonyx* (Canarias; STOCK & RONDÉ-BROEKHUIZEN, 1986), *Liagoceradocus* (Canarias; STOCK & ILIFFE, 1991), *Ingolfiella* (*Antilleella*) (Madeira, Canarias; (STOCK, 1993a), and *Bogidiella* (Madeira, Canarias; STOCK, 1995a);
- other crustaceans: the thermosbaenacean *Halosbaena* (Canarias; WAGNER, 1994), the mysid *Heteromysoides* (Canarias; WILKENS et al., 1986), the ostacod *Danielopolina* (Canarias; BALTANÁS & DANIELOPOL, 1995), the misophrid copepod *Expansophira* (Canarias; BOXSHALL & ILIFFE, 1987), the remiped *Speleonectes* (Canarias; SCHRAM et al., 1986; YAGER, 1994), the isopod *Curassanthura* (Canarias; WÄGELE, 1985), the decapods *Typhlatya* and *Procaris* (both Ascension; CHACE & MANNING, 1972), and several others;
- the polychaete *Namanereis* (Madeira, Cape Verdians, St. Helena; STOCK, 1993b).

Their relatives outside the Mid-Atlantic islands can be found in the belt once washed by the circum-tropical Tethys Sea, which existed from the Late Trias to the Miocene, ca. 200-20 million years (My) ago, covering the Mediterranean, the West Indies, the Galapagos islands, and to the east Somalia, eastern Asia, Indonesia, and parts of Australia.

It won't be necessary in this context to dwell upon these Tethyan distribution patterns, since they have been studied recently by several authors (e.g. STOCK, 1977a, 1977b, 1990b, 1993b, 1994; WÄGELE, 1985; ILIFFE, 1992; KNOTT, 1993; BALTANÁS & DANIELOPOL, 1995; JAUME, 1995).

It looks more important to point out a hitherto unnoticed pattern in common to all these Tethyan descendants: they occur in considerable diversity, both in number of species and in number of higher taxa, on the *northern* islands of the Mid-Atlantic, especially in the archipelagoes of Madeira and the Canarias (the Azores are practically unstudied in this respect), but in much lower diversity in the *southern* islands, i.e. the Cape Verde group, Ascension and St. Helena. The aquatic crustacean fauna of these islands has been studied during the last decade or so. Today we have analyses available of several hundreds of samples taken on the southern islands (STOCK & VONK, 1989; STOCK, 1995b), and we have come across only a very limited number of species. For Ascension, which is a very arid island, without any permanent streams (but which have a most interesting anchihaline habitat, the so-called Coral Pools) this is perhaps understandable, but the poor biodiversity is less easily understood for St. Helena, rich in streams and springs, and for the Cape Verdians, more arid but still with numerous streams and with a reasonable supply of ground water. The geological age alone of the islands cannot form an explanation, because radiometric datings of the volcanic rocks show considerable differences between each island, ages ranging from less than 1 My to 145 My. Irrespective of age, the low number of stygobionts forms a common trait in these islands (Table I).

The table shows that only a few groundwater species per island or per island group

have been discovered, a number very low compared to the dozens of species known from the northern island groups.

What could be the reason for this poverty? We assume the reason can be found in the paleohistory of the Atlantic. The northern islands, or the primordials thereof, were under Tethyan influence during some 180 My. In contrast, the southern group was in contact with the Southern Ocean through the rift that started to develop between Africa and South America in the Cenomanian (= Mid-Jurassic, *c.* 160 My ago. This rift gradually stretched out further north, until it got connection with the Tethys Sea in the Mid-Cretaceous, *c.* 90 My ago. The presence of such low numbers of old Tethyan stygofaunal elements on the southern islands is understandable in the light of the relatively late contact with the Tethys. The island age, as computed from radiometric (K-Ar, Ar40-Ar32, Sr87-Sr86) datings of the lavas (MITCHELL-THOMJ, 1982) seems unrelated with the presence or absence of Tethyan stygofaunal elements. Similar-sized islands like the central Azores, La Palma, Hierro, Brava and Ascension (all estimated of Pliocene-Pleistocene age, 0-3 My old) do not differ markedly in number of Tethyan elements from La Gomera, Maio, or St. Helena (all much older).

STOCK, 1996, noting the disconcerting radiometric and biogeographic data, supposed that primordials of the northern Mid-Atlantic islands are older (at least early Miocene), but probably much older, when these primordials were still close to Tethyan shore-lines (late Mesozoic or early Tertiary). Of course it is possible that these primordials were still under sea-level, although at shallow depths, since they harboured already the shallow-water ancestors of the present-day Tethyan talassoid descendants.

Although St. Helena (emerged from the sea, thus available for evolution of stygobionts, some 14 My ago; WEAVER, 1991) is allegedly very much older than Ascension (estimates ranging from 1-1.5 My, according to WILSON, 1963, and BELL in Chace & Manning, 1972 to 0.01 My, according to DUFFEY, 1964), both islands have about the same low number of old stygobiont species. From the south (series St. Helena-Ascension-Cape Verde group) to the north (Canary and Madeira archipelagoes) the number of Tethyan elements increases. The later and shorter contact with the Tethys appears to be influenced the distribution of Tethyan elements on the southern Mid-Atlantic islands.

I may add two final remarks:

(1) Our knowledge about the hypogean (and epigeal) aquatic crustaceans on the Azores is still very fragmentary. A detailed systematic survey of the major islands of the Azores group would be most welcome.

(2) The terrestrial crustaceans of most Mid-Atlantic islands are reasonably well known, but are of little use in biogeographic studies, since they are easily transported by human activities, like introduction through ornamental plants or crops. Certain is that landhoppers (Amphipoda, Talitridae: genera *Orchestia*, *Platorchestia*, *Macarorchestia*, *Palmorchestia*) are well represented on the islands. They are most probably derived from

coastal or shore ancestors. Some of them are endemic to one island, others are more widespread (STOCK, 1989a, 1989b, 1990a, and in press; STOCK & ABREU, 1994; STOCK & BIRNBAUM, 1994; RUFFO, 1990; STOCK & MARTRN, 1988; STOCK & BOXSHALL, 1989). So far, no terrestrial amphipods have been recorded from the Cape Verde Islands.

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TABLE I - Stygobionts known from the southern Mid-Atlantic islands (T = Tethyan element; E = endemic; C = circumtropical element)

Cape Verde group (all from Santiago, but for *Namanereis* from Maio)

Amphipoda	-- <i>Dulzura</i> (1 species, T, Stock & Vonk, 1991)
	-- <i>Cabogidiella</i> (1 species, E, Stock & Vonk, 1992)
	-- <i>Idunella</i> (1 species, T, Stock & Vonk, 1992)
	-- <i>Psammogammarus</i> (1 species, T, Stock & Vonk, 1992)
Isopoda	-- <i>Caecostenetroides</i> (1 species, T, Stock & Vonk, 1992)
Polychaeta	-- <i>Namanereis</i> (= <i>Lycastopsis</i>) (1 species, T, Hartmann-Schröder, in litt., 1992)

Ascension

Decapoda	-- <i>Typhlatya</i> (1 species, T, Chace & Manning, 1972)
	-- <i>Procaris</i> (1 species, T, Chace & Manning, 1972)
Isopoda	-- <i>Caecostenetroides</i> (1 species, T, Vonk & Stock, 1991)

St. Helena

Tanaidacea	-- <i>Tanais</i> (1 species, C, Monod, 1977)
Isopoda	-- <i>Iais</i> (1 species, nearest relative on Tristan da Cunha, Coineau, 1977)
Polychaeta	-- <i>Namanereis</i> (= <i>Lycastopsis</i>) (1 species, T, Glasby, in litt., 1995)

The presence of each species in the above list has been confirmed by personal observations.

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