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Biological groundwater studies in Ascension Island (South Atlantic), October – November 1989

by

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INTRODUCTION

Ascension Island (08° S 14°25' W) occupies a very peculiar place in our current research project on the biological properties of ground waters of the the Mid-Atlantic islands:

-- The island lies closer to the equator than any of the other Mid-Atlantic islands.

-- The island lies almost on the Mid-Atlantic Ridge, and far remote from any other insular or continental region.

-- The island's subaerial part consists of very young volcanic outcrops (dated radiometrically at 1-2 My).

Through these properties, the comparison of Ascension with the intensively studied Canary Islands (see the series of publications of our team under the collective title "Stygofauna of the Canary Islands", parts 1 to 19) is of great importance for a better understanding of dispersal and/or vicariant processes in the evolution of insular groundwater organisms (or *stygobionts* as these are called scientifically).

If "old" (as determined by plesiomorphic character states or a large, mainly Tethyan, distribution) stygobionts are present on an island like Ascension, this may mean that an emerged primordial island was present long before the presently exposed lavas were deposited. If the presence of very poor dispersers (and several stygobionts classify as such) is demonstrated, this may indicate that the primordial island once was closer to, or even in contact with, other subaerial or shallow-water areas. If the presence of stygobionts with deep-sea affinities is demonstrated, the island may have built up from the deep-sea floor by volcanic activities.

Prior to our studies, only two stygobionts were known from Ascension: the shrimps *Typhlatya rogersi* and *Procaris ascensionis* (see Chace & Manning, 1972; Provenzano, 1978; Abele & Felgenhauer, 1985). The present study has revealed the presence of quite a few more stygobionts on the island.

METHODS

The following methods have been employed to obtain our samples:

(1) The use of a Bou-Rouch biophreatical pump: a steel probe of a Norton-type pump is hammered into the substrate, well into the ground water, and the water pumped up is filtered through a 300 µm sieve. With this method essentially loose sediments at any given place can be sampled, provided the phreatic level is not too deep under the surface, and provided the sediment layers are not too thin.

(2) The use of a Cvetkov vertical, self-closing net of various diameters (4, 6 or 16 inch), in existing wells or bore-holes.

(3) The method Karaman-Chappuis: a hole is dug into the sediments and the inflowing ground water is collected and filtered through a 300 µm mesh sieve. This method can be employed, where the methods (1) and (2) cannot be used. In Ascension this is mainly the case in areas in which thin sediments layers overlay solid volcanic rock.

The following types of habitats have been sampled:

(a) (Deep) wells, reaching to the phreatic level (very rare in Ascension).

(b) Springs and trickles, usually called "drips" in Ascension. Most of the drips were dry during our survey, notwithstanding a long-lasting wet period, probably because the vegetation cover of the island has greatly expanded during the last 10 decades (Atkins et al., 1964; A. Peters, pers. comm.),

(c) Reservoirs, tanks and basins (in Ascension exclusively fed by run-off or catchments).

(d) Bore-holes (in Ascension all existing experimental bore-holes were found dry, but certain bore-holes used to obtain salty water, for cooling or drinking water production, were sampled).

(e) Anchihaline pools, fed by sea water, via subterranean connections. (In Ascension, only the various Shelly Beach pools fall in this category).

(f) Sediment layers of sandy and gravelly beaches (fairly abundant in Ascension, though difficult to sample, due to swell and underlying bed rock).

Due to the lack of (semi-)permanent streams on Ascension, no river sediments suitable for sampling have been found.

All geographic references pertain to the 1 : 25,000 map of Ascension Island, published by the Directorate of Overseas Surveys (D.O.S 327), London, 1967 (reprinted 1988), and the 1982 Partial Revision by the 42 Survey Engineer Department. UTM (Universal Transverse Mercator) grid references all pertain to grid zone ES.

Many of the localities sampled are briefly described in "The Ascension Island Handbook" by J.E. Packer, 3rd edition, 1983, published by the Ascension Historical Society.

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STATION LIST

The sequence of the Station List is as follows:
Station number, locality name, type of habitat, UTM grid coordinates, gear used, conductivity of the ground water, temperature of the ground water, date of sampling, provisional biological inventory.

89–900. Shelly Beach, Marl Pool (= westernmost chain of 2 marl pools without surface connection to the Coral Pools); very muddy anchihaline pools with several "bull eyes" (upwelling of salty water through heliocrenes) and a resurgence of salty water from a rock crevice; UTM ^{s}6633 ^{91}1652; fine handnet (mesh 300 µm) in resurgence; cond. pool 49.7 mS/cm; cond. resurgence 49.5 mS/cm; temp. pool 30.0° C; temp. resurgence 25.2° C; 31 Oct. 1989; Actiniaria, Polychaeta, Sphaeromatidae.

89–901. Same place as 89–900, but handnet catch in the pool itself; 1 Nov. 1989; *Typhlatya*, Polychaeta, Sphaeromatidae.

89–902. Shelly Beach, Coral Pool (= easternmost anchihaline pool); bottom covered by *Favia* (coral), stones and algae; UTM ^{s}6660 ^{91}1653; fine handnet; cond. 51.5 mS/cm; 29.0° C; 1 Nov. 1989; *Fissurella* (Gastropoda), *Procaris* and *Typhlatya* (shrimps), Amphipoda, sponges, Polychaeta, Sipunculida, corals.

89–903. Shelly Beach, tidal zone, small bank of coarse sand on shore of small rock pool; UTM ^{s}6640 ^{91}1653; Bou–Rouch pump, probe at 50 cm; cond. 52.8 mS/cm; 26.0° C; 1 Nov. 1989; Amphipoda, Isopoda, Harpacticoida.

89–904. Shelly Beach, tidal zone, bank of nodules of calcareous algae and coral sand; Bou–Rouch pump, probe at 45 cm; UTM as 89–903; 2 Nov. 1989; Amphipoda, shrimps, Tanaidacea, Isopoda, Pycnogonida.

89–905. Shelly Beach, same place as 89–904, but method Karaman–Chappuis in rubble bank in rock pool; 2 Nov. 1989; Amphipoda.

89–906. Shelly Beach, Coral Pool (see 89–902); cond. 50.1 mS/cm; 27.0° C; 2 Nov. 1989; sponges, Amphipoda, *Procaris*, Idoteid isopods.

89–907. Shelly Beach, Marl Pool; resurgence (see 89–900); Bou–Rouch pump in inflowing water from cleft in rocks, probe at 45 cm; 2 Nov. 1989; Sphaeromatidae (Isopoda), Tanaidacea; Polychaeta, Actiniaria; tube worms.

89-908. English Bay; coarse intertidal sand composed mainly of debris of calcareous algae, in small sheltered cove; UTM ^{5}6802 ^{91}2740; Bou-Rouch pump, probe at 50 cm; 3 Nov. 1989; very clean; Tanaidacea, Cyclopoida, Polychaeta.

89-909. B.B.C. Power Station (English Bay); bore-holes (diameter 15 cm) for production of cooling water; UTM ^{5}6831 ^{91}2751; 20-30 m from the sea, bored in lava; small Cvetkov net; depth to water surface c. 5 m; water depth c. 3.6 m; cond. 49.3 mS/cm; 26.0° C; 3 Nov. 1989; clean; no fauna.

89-910. Breakneck Valley, Octogon Tank; UTM ^{5}7168 ^{91}2082; disused storage tank for water from well and catchment; altitude above sea level c. 2400 ft.; large Cvetkov net and hand collecting under wet and humid stones; cond. 462 µS/cm; 18.3° C; 4 Nov. 1989; land snails, terrestrial isopods, Oligochaeta, flatworms, terrestrial Talitridae (Amphipoda).

89-911. The Pines (bottom of Breakneck Valley), near watertank; UTM ^{5}7195 ^{91}2094; altitude c. 2200 ft.; large Cvetkov net and hand collecting under humid stones and wood; cond. 250 µS/cm; 18.9° C; 4 Nov. 1989; terrestrial Talitridae, Insecta, Gastropoda, flatworms.

89-912. South West Bay, near pump house of seawater distillation plant; UTM ^{5}6475 ^{91}9153; Bou-Rouch pump in rusty brown lava sands, probe at 55 cm; shore of high-littoral rock pool; cond. 53.9 mS/cm; 27.4° C; huge swell; 5 Nov. 1989.

89-913. Same locality as 89-912, but in calcareous sand, rockpool lower in littoral zone; Bou-Rouch pump, probe at 30 cm; cond. 53.7 mS/cm; 26.1° C; 5 Nov. 1989.

89-914. Same locality, but more protected rock pool; clean; Bou-Rouch pump, probe at 35 cm; cond. 63.3 mS/cm; 27.6° C; 5 Nov. 1989; calcareous algae, molluscs, oligochaetes.

89-915. Sandy Run, coast, mouth of dry stream; UTM ^{5}6778 ^{91}1675; method Karaman-Chappuis in coarse sand on basaltic underground; strongly exposed coast with some rock pools; cond. 53.2 mS/cm; 29.3° C; 6 Nov. 1989; oligochaetes.

89-916. Lady's Loo (north coast between North Point and Porpoise Point); UTM ^{5}7005 ^{91}2700; fine handnet in protected rock pool; 6 Nov. 1989; Holothuria, ascidians, sponges, snails; in sand: harpacticoids, oligochaetes.

89-917. North Point, Clinker Club; UTM ^{8}6878 ^{91}2762; coarse coralligenous sand on basaltic underground; method Karaman-Chappuis; marine; 7 Nov. 1989; Amphipoda, Tanaidacea, gastropods.

89-918. South West Bay: Panam Beach, Turtle Pond; UTM ^{8}6472 ^{91}1905; clean, very coarse coralligenous sands; Bou-Rouch pump, probe at 40 cm; slightly below low tide line; also from sand washings; marine; 7 Nov. 1989; Polychaeta, Oligochaeta, Harpacticoida, Tanaidacea, flatworms.

89-919. Elliot's Path tunnel (The Mountain); drip; UTM ^{8}7183 ^{91}2104; muddy, shallow (0-10 cm) puddles on bottom of tunnel; altitude c. 2500 ft.; fine hand net; cond. 434 µS/cm; 17.6° C; 8 Nov. 1989. No fauna.

89-920. Breakneck Valley, deep well (depth 47 ft.), under roof, with motor pump; UTM ^{8}7148 ^{91}2095; altitude c. 2400 ft.; large Cvetkov net; very clean; 8 Nov. 1989.

89-921. Dampier's Spring. UTM ^{8}7118 ^{91}2180; altitude c. 1100 ft.; no water, but hand collecting in humid loam and leaf debris; 8 Nov. 1989; terrestrial Talitridae, scorpions, insects, spiders, Collembola, Isopoda, snails, land crabs.

89-922. Panam Beach, Turtle Pool (see 89-918); washings from coarse, coralligenous sand, water depth c. 0.5 m; 8 Nov. 1989; Polychaeta, Oligochaeta, flatworms, Sipunculida, Amphipoda, Tanaidacea, Harpacticoida.

89-923. Same locality as 89-922, but Bou-Rouch pump in sand near low tide line; 8 Nov. 1989; Harpacticoida.

89-924, Shelly Beach, western end; UTM ^{8}6633 ^{91}1651; Bou-Rouch pump in very coarse coralligenous sand; probe at 30 cm; water depth c. 30 cm; sheltered marine pools at low tide; 9 Nov. 1989; Amphipoda, Isopoda, Polycladida, Harpacticoida, Tanaidacea.

89-925. Almost same place as 89-924, but washings of 'golf balls' (concretions and nodules of calcareous algae); sediment layer of some 30 cm, on bed rock; sheltered pool at low tide line; 9 Nov. 1989; Amphipoda, Tanaidacea, Isopoda, flatworms, Polychaeta.

89-926. Near 89-925, but washings from finer coralligenous gravel; 9 Nov. 1989; Amphipoda, Tanaidacea, Polychaeta.

89–927. Slightly east of 89–926; bank of coralligenous gravel and sand, in marine pool, locked off from the sea at low tide; Bou–Rouch pump, probe at 40 cm; 9 Nov. 1989; Polychaeta, Oligochaeta, Amphipoda, Tanaidacea, Harpacticoida.

89–928. Same place as 89–927, but washings of coarse sand; same date and same animals as in 89–927.

89–929. Shelly Beach, easternmost Coral Pool; UTM, see 89–902; Bou–Rouch pump through coral cover, probe at 50 cm; 9 Nov. 1989; *Typhlatya*, *Procaris*, Amphipoda, Tanaidacea, Copepoda, Polychaeta, Oligochaeta.

89–930. Same as 89–929, but probe at 70 cm; gray, fine mud; 9 Nov. 1989; Ophiura, Amphipoda, Tanaidacea, Copepoda, *Typhlatya*, Polychaeta, Gastropoda.

89–931. Series of rock pools W. of Mars Bay; UTM ^{5}6585 ^{91}1708; sheltered pool, with calcareous and other algae, *Favia*, sea urchins, fish; washings of gravel and sand; 10 Nov. 1989; shrimp, Amphipoda, Harpacticoida, Oligochaeta, Polychaeta.

89–932. Shelly Beach, central part of beach; UTM ^{5}6650 ^{91}1621; Bou–Rouch pump in coarse sand, shells, maerl, at high tide mark; 10 Nov. 1989; Amphipoda, Harpacticoida, Cyclopoida, Ostracoda.

89–933. Same locality as 89–929; hand collecting in shady crevices; 10 Nov. 1989; solitary corals, 2 species of hermatypic corals, sponges.

89–934. Gannet Bay; UTM ^{5}6704 ^{91}1655; elongate rock pool, fed by spray; washings of coarse sand; 10 Nov. 1989; Amphipoda, Harpacticoida.

89–935. Piper's Drip; UTM ^{5}7185 ^{91}2145; catchment from mountain slope in concrete open basin with trough; alt. c. 1800 ft.; leaves, mud; small hand net; cond. 952 µS/cm; 18.9° C; 11 Nov. 1989; land crabs.

89–936. Flat Drip; UTM ^{5}7212 ^{91}2152; catchment from mountain slope in large, clean concrete basin and trough; alt. c. 1800 ft.; small handnet; cond. 389 µS/cm; 19.6° C; 11 Nov. 1989; mosquito larvae.

89–937. Castle's Drip; UTM ^{5}7220 ^{91}2022; tank dry; sample taken in trough, shadowed by "cedar tree"; small handnet; altitude 1700 ft.; cond. 453 µS/cm; 19.9° C; Ostracoda, Talitridae, Insecta, Gastropoda, Isopoda.

89-938. Dampier's Spring (same as 89-921); land fauna in loam and leaf debris; 11 Nov. 1989; Talitridae, spiders, Insecta, Isopoda, Gastropoda.

89-939. Just below The Peak, "The Piggery"; UTM ^{5}7170 ^{91}2103; estimated altitude 2500 ft.; under stones and wood; 11 Nov. 1989; Insecta, Talitridae, Isopoda.

89-940. South of South West Bay; sheltered rock pools; UTM ^{5}6473 ^{91}1897; algae, sea urchins; washings of coarse sand; 12 Nov. 1989; Polychaeta, flatworms, Harpacticoida, Tanaidacea, Amphipoda.

89-941. Hummock Point, just NW of Blowhole; UTM ^{5}7382 ^{91}2482; intertidal rock pool; method Karaman-Chappuis in coarse sand; clean; 13 Nov. 1989; Harpacticoida.

89-942. Hummock Point, just NW of Hummock Gut; UTM ^{5}7375 ^{91}2475; washings of coarse and fine sands, in high tidal rock pool; rich in H_2S, black colour; many dead algae; 13 Nov. 1989; Bivalvia, Anomura, Oligochaeta, Polychaeta.

89-943. Lower Valley Drip; UTM ^{5}7105 ^{91}2277 (=just below Dampier's Drip); fine hand net; alt. c. 1050 ft.; cond. 1424 µS/cm; 22.5° C; 14 Nov. 1989.

89-944. Hummock Point, sandy beach; UTM ^{5}7400 ^{91}2470; Bou-Rouch pump in coarse, clean sand, at various places at low tide line; probe at 40 cm; rather exposed; 14 Nov. 1989; Tanaidacea, Microparaselllidae, Polychaeta.

89-945.George-Town, cistern of Post Office; UTM ^{5}6478 ^{91}2350; closed reservoir, water level at 1 m, water depth 1 m; cond. 233 µS/cm; 26.4° C; very clean; large Cvetkov net; 14 Nov. 1989; Cyclopoida.

89-946. George-Town, cistern E.-side of Historical Museum; UTM ^{5}6475 ^{91}2357; closed reservoir; more polluted than 89-945; water level at 0.5 m, water depth 1m; large Cvetkov net; cond. 234 µS/cm; 24.0° C; 14 Nov. 1989. No fauna.

89-947. George-Town, cistern W.-side of Historical Museum; UTM see 89-946; closed reservoir, very clean; water level at 1 m, water depth 0.5 m; cond. 244 µS/cm; 28.2° C; 14 Nov. 1989. No fauna.

89-948. George-Town, cistern of Office A.I.S. Builder's Yard; UTM ^{5}6470 ^{91}2375; closed reservoir; water level at c. 4 m,water depth c. 2 m; very clean; large Cvetkov net; cond. 204 µS/cm; 23.6° C; 14 Nov. 1989. No fauna.

89-949. Hummock Point (see 89-944), washings of littoral coarse sands; 15 Nov. 1989; Hippidae, crusteacean larvae, Tanaidacea, Harpacticoida.

89-950. Hummock Point, extreme SE end of beach (UTM almost as 89-944); in coarse quicksands; Bou-Rouch pump, probe at 100 cm; 16 Nov.1989; Microparasellidae, Ostracoda.

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