

The Age of the Cape Verde Islands¹

GIJSBERT J. BOEKSCHOTEN & JAN A. MANUPUTTY

Introduction

The CANCAP-expeditions focused on marine bio-systematics and biogeography of the seas around the Middle Atlantic island groups. An appropriate geological background was provided in MITCHELL-THOMÉ's monumental monograph published in 1976, just at the onset of the CANCAP-campaigns. The paleontology of the Middle Atlantic islands helps to understand biogeography and evolution in two ways. First, outcrops are dated and interpreted by biostratigraphical analysis. This gives exact data on the availability and nature of environments for organisms on and around islands in the past. Such analysis has made clear that Cretaceous deposits, exposed now on Fieraventura and Maio are deep sea deposits that underwent much later uplift. These sediments and the fossils therein are unrelated to the Middle Atlantic islands, as we know them nowadays. Secondly, the study of actual fossils provides data on systematical and biogeographical patterns in the past. CANCAP results in this aspect comprise Miocene and Pleistocene terrestrial gastropods from the area (GITTENBERGER & RIPKEN 1985; BOEKSCHOTEN & GITTENBERGER 1987) as well as Quaternary shallow water corals (BOEKSCHOTEN & BEST 1981, 1988; BEST & BOEK-

SCHOTEN 1982). The present paper will deal with the first aspect, and tries to answer how old the island of S. Nicolau is at least.

The sheer volume of the Cape Verde bulge on the Atlantic ocean floor would suggest that volcanic activity and eustatic uplift started already well down in the Tertiary. It is tempting to consider the Eocene basalts of Cape Verde in Senegal as the first indication of the activities of a volcanic hotspot in the earth's mantle, uncovered by the eastward movement of the passive margin of the African continent. This would imply a younger age of the westernmost Cape Verde vulcanoes; also a gradual evolution from islands adjacent to the Senegal coast to completely oceanic volcano islands on the western half of the Cape Verde bulge.

The various small inliers of shallow marine and terrestrial sediments, overlain and preserved by lava flows, were dated as older Tertiary or even Cretaceous in the literature. Many of these could be dated as Quaternary, on the strength of macrofossil analysis and radiometric data (ROTHE 1982; BOEKSCHOTEN & BEST 1988). Some deposits remained that did not contain significant macrofossils, and were not surrounded by datable volcanic material. One of these is the lens of marine sediment at Preguiça, S. Nicolau.

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The Preguiça site and its fauna

This site was first described by BEBIANO (1932). Exposures are found along the old road from Preguiça on the coast to the islands capital, Ribeira Brava, at the southwestern rim of the Campo de Preguiça on which the airstrip is located. The deposits, tilting about 45° westward and also fractured, are exposed at a height of about 250 meters. On the strength of some badly preserved shells and because of its tectonic situation, older literature considers these strata as Eocene, as Senonian or even Middle Cretaceous. Two samples were taken during the 1986 CANCAP expedition, and submitted to micropaleontological analysis.

The material from the thinner, southeastern occurrence contained mollusc fragments, echinid spines and rather poorly preserved foraminifers:

planktonic:

- Globigerinoides trilobus* (REUSS)
- Globigerinoides sacculiferus* (BRADY)
- Globigerinoides obliquus* BOLLI
- Globorotalia menardii* (PARKER, JONES & BRADY)
- dextral

benthic:

- Amphistegina lessonii* d'ORBIGNY
- Cibicides lobatulus* WALKER & JACOB
- Cibicides* sp.
- Lenticulina* sp.
- Cassidulina* sp.
- Sphaeroidina* sp.
- Miliolidae

The material from the thicker northwestern occurrence contained echinid spines and a well preserved foraminifer fauna:

planktonic:

- Globigerinoides trilobus* (REUSS)
- Globigerinoides obliquus* BOLLI
- Orbulina* sp.
- Globigerina bulloides* d'ORBIGNY
- Globigerina quinqueloba* NATLAND
- Globorotalia menardii* (PARKER, JONES & BRADY)
- dextral
- Globorotalia hirsuta* (d'ORBIGNY) - sinistral
- Globorotalia scitula* (BRADY) - dextral
- Globorotalia pseudopima* BLOW - sinistral
- Neogloboquadrina dutertrei* (d'ORBIGNY) - sinistral

benthic:

- Amphistegina lessonii* d'ORBIGNY
- Cibicides lobatulus* (WALKER & JACOB)
- Cibicides* spp.
- Bolivina* cf. *robusta* BRADY
- Uvigerina* spp.
- Cassidulina subglobosa* BRADY
- Angulogerina* sp.
- Lenticulina* sp.
- Pullenia* sp.

Apart from their sites, there is no indication that both samples were not taken from the same deposit. The microfauna is composed of species that did not live at one and the same site. *Amphistegina* is a shallow water foraminifer, biologically dependent on influx of sunlight and therefore common only in the photic zone upwards from 50 m water depth, usually in environments with firm substratum in subtropical

and tropical seas. The *Amphistegina*'s suggest that at the time of deposition of the Preguiça deposit some pre-Nicolau island was already extant, that provided an environment favourable for *Amphistegina* along its coast.

The planktonic species prove an uppermost Pliocene - lowermost Pleistocene age, according to the BOLLI & SAUNDERS (1985) zonation. The benthic *Amphistegina* shells must have slid down along the submarine volcanic slopes of pre-Nicolau to a depth of at least 200 m, where the shells of the planktonic assemblage could settle. The tilting of the deposits may represent the original submarine topography. The small-scale fracturing may well be related to down-sliding of sediment accumulations on this slope. This suggests that the eastern half of S. Nicolau is older than the western side; and that it rose approximately 500 m since the deposition of the Preguiça limestone. Ecological aspects of the planktonic fauna, with many tropical/subtropical species and some more temperate species (*Globigerina quinqueloba*, *G. bulloides* and *Globorotalia scitula*) suggest an age at the onset of the Pleistocene, as indicated also by the stratigraphic ranges of the species observed.

The fossiliferous site between Preguiça and Ribeira Brava is the only elevated inland site of marine sediment on S. Nicolau. Other sites on the island, such as those directly NE and S of Preguiça, consist of rhodolite limestones with an *Amphistegina* microfauna. Such sites found also on other Cape Verde islands (BOEKSCHOTEN & BEST 1988) are closely related to extant topography. Their age is late Quaternary.

Conclusions

Development of the Cape Verde Archipelago may have started close to the Senegalese coast, in the Eocene; but early islands vanished deep below sea level since. The easternmost extant islands may have emerged in the Miocene, but only Maio (STILLMAN 1982) and S. Nicolau have proven Pliocene ages. On the other islands only Quaternary sediments are found.

Literature

- BEBIANO, J.B. (1932): A Geologia do arquipélago do Cabo Verde. - Comun. Serv. Geol. Portugal, 18: 51-275.
- BEST, M.W. & BOEKSCHOTEN, G.J. (1982) On the coral fauna in the Miocene reef at Baixo, Porto Santo. - Neth. Journ. Zool., 32: 412-418.
- BOEKSCHOTEN, G.J. & BEST, M.B. (1988): Fossil and recent shallow water corals from the Atlantic islands off Western Africa. - Zool. Meded. Leiden, 62: 99-112.
- BOEKSCHOTEN, G.J. & BEST, M.W. (1981): *Pocillopora* in the Miocene reef at Baixo, Porto Santo. - Proc. Kon. Ned. Akad. Wetensch. Amsterdam, (B) 84: 13-20.
- BOEKSCHOTEN, G.J. & GITTENBERGER, E. (1987): Fossil terrestrial snails from the Cape Verde archipelago. - Basteria, 51: 125-127.

- BOLLI, H.M. & SAUNDERS, J.B. (1985): Oligocene to Holocene low latitude planktic foraminifera. - *Plankton Stratigraphy*, 1: 155-262.
- GITTENBERGER, E. & RIPKEN, TH.E.J. (1985): Seven late Miocene species of terrestrial gastropods from the island of Lanzarote, Canary Islands. - *Proc. Kon. Ned. Akad. Wetensch. Amsterdam*, (B) 88: 397-406.
- MITCHELL-THOMÉ, R.C. (1976): Geology of the Middle Atlantic Islands. - *Beitr. Region. Geol. Erde*: 382 pp.; Borntraeger, Berlin, Stuttgart.
- ROTHER, P. (1982): Zur Geologie der Kapverdischen Inseln. - *Cour. Forsch.-Inst. Senckenberg*, 52: 1-9; Frankfurt a.M.
- STILLMAN, C.J., FURNES, H., LEBAS, M.J., ROBERTSON, A.H.F. & ZIELONKA, J. (1982): The geological history of Maio, Cape Verde islands. - *Journ. Geol. Soc. London*, 139: 347-361.

The authors' address

G.J. BOEKSCHOTEN and J.A. MANUPUTTY, Instituut voor Aardwetenschappen, Vrije Universiteit, P.O. Box 7161, NL-1007 MC Amsterdam, The Netherlands.