



Shelf architecture and recent sediment stratigraphy of the Chameis Bay area, southern Namibia

Heike Fourie^{1,2} · Bjorn P. von der Heyden¹ · Kegan Strydom³

Received: 19 January 2021 / Accepted: 12 May 2021

© The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2021

Abstract

Chameis Bay is located about 115 km north of the Orange River mouth and falls within the Sperrgebiet, an area which hosts the world's largest gem diamond deposit. Although significant quantities of diamonds have been recovered both on land and from offshore deposits in the Chameis Bay area, the marine geology of this important tract of coastline has not previously been described in the scientific literature. Here, we report the nearshore geomorphology and seismic stratigraphy offshore of Chameis Bay through analyses of bathymetrical and seismic datasets. These data have been complemented with lithological data obtained from 70 reverse-circulation boreholes which helped to confirm and constrain the sedimentary stratigraphy of the study area. These datasets identified four major lithological units; viz. a Precambrian basement which predominates as the footwall in the nearshore regions of the study area, a Cretaceous clay unit that represents the offshore footwall lithology and two unconsolidated Cenozoic sedimentary units. The distribution of these unconsolidated sediments is strongly controlled by the ambient accommodation space which can be quantified by considering the architecture of the respective footwall units. Architectural features within the study site include two prominent wave-cut platforms, two coast-parallel sea cliffs, and a shelf-break formed at the contact between the Precambrian basement and the Cretaceous clay footwall. Accommodation space exists on the seaward of the two wave-cut platforms, which is cut into the Precambrian basement footwall and which lies below the fair-weather wave base, and at the break in slope at the contact between the two footwall units. The former accommodation space is most notable for gravel entrapment and preservation since gully-controlled jointing and erosional depressions at lithological contacts represent 'fixed' trapsites from which coarse material is less likely to be remobilised. In contrast, the trapsites formed on the soft Cretaceous clay footwall are regarded as 'mobile' trapsites since they can be easily reconfigured by continuing erosional processes. As a result, the gravel bodies found above the Cretaceous clay are generally thin and poorly developed. The implications of these two different trapsites are briefly discussed in terms of diamond preservation potential, where anticipated diamond sources to the Chameis Bay near-shelf include the Orange River mouth as well as material that has been reworked from proximal sources. These results represent the first detailed description of the marine geology of the Chameis Subterranean thrust sheet and complement existing understanding of the Sperrgebiet's marine geology which largely derives from study sites on the Oranjemund Subterranean where linear beaches predominate.

Introduction

The southern African western margin hosts the world's largest placer diamond accumulation; a so-called diamond 'mega-placer' that spans the South African north-west coast, the lower reaches of the Orange River (a point source into the marine domain), and both offshore and onshore along the southern Namibian coastline (see De Wit et al. 2016 for a recent review). As the land-based diamond resources (e.g. river terraces and raised beaches) of this world-class deposit are increasingly being depleted, scientific attention and mining industry operations are increasingly focused on the offshore marine resources, which are typically more difficult

This article is part of the Topical Collection on *Coastal and marine geology in Southern Africa: alluvial to abyssal and everything in between*

✉ Bjorn P. von der Heyden
bvon@sun.ac.za

¹ Department of Earth Sciences, Stellenbosch University, Private Bag X1, Matieland, Stellenbosch 7602, South Africa

² Tect Geological Consulting, Unit 3, Metrohm House, 20 Gardner Williams Avenue, Cape Town 7130, South Africa

³ Namdeb Diamond Corporation (Pty) Ltd, PO Box 253, Oranjemund, Namibia