1. INTRODUCTION

This study covers the areas of the Gawib River Valley, the Tumas River Valley, the Dorstrivier area and the diatomaceous muds in the anaerobic basins on the conti= nental shelf. The localities are shown on the Gemini Satellite photograph (Fig. 1).

The main physical features are the Swakop, Khan and Kuiseb canyons, the Husab, Witpoort, Langer Heinrich, Schieferberge and Chuos Mountains, and the extensive flat regions which form the Namib Plain. Ephemeral drainage courses such as the Tumas River cross the plain from east to west.

Rainfall at Swakopmund over 35 years averages 18 mm per year (Nagel, 1962) which increases to 150 mm further inland (Smith, 1965, p. 6). Most of the precipitation in the Namib Desert is from fogs blown inland from the sea, and amounts to 130 mm per year (Nagel, 1962).

In the Namib Desert there are essentially two types of uranium deposits that are associated with the rocks of the Damara Orogen. The first of these is the primary "porphyry"-type mineralization (Armstrong, 1974) found in granitic rocks closely associated with the highest meta= morphic grade. Deposits at Rössing and Goniakontes are typical examples. The second type of deposit comprises the epigenetic uranium occurrences which are found in the duricrusts which form a superficial calcareous cover over a large part of the Namib Desert. A number of mining companies are currently engaged in prospecting programs embracing these two types of mineralization.

During 1970 and 1974 the Geological Survey of South Africa undertook airborne magnetic and aeroradiometric surveys of an area east of Walvis Bay. The most promising radio= metric anomalies were subsequently taken out under concession by mining companies. To the north of the area, Anglo American Prospecting Co. Ltd took the farms Dorst= rivier 15, Nordenburg 76, Vlakteplaas 110 and part of Bloemhof 109. In 1974 they were granted three concessions falling mostly within the Tumas River Valley. General Mining and Finance Corp. Ltd was granted the Gawib River Valley in the vicinity of the Langer Heinrich Mountain in 1973.

Uranium occurrences in calcrete have also been reported from Yeelerrie in Western Australia (Langford, 1974), Somalia (Dall'Aglio and others, 1974) and the Gobi Desert in China (personal communication, Dr A. Clark, AAEC). The chances are good that similar deposits will be discovered elsewhere, for deserts cover large areas of the earth's surface. Gypcrete uranium deposits may be unique to the Namib Desert, for as yet none have been reported from other parts of the world.

The main purpose of this investigation was to determine the geochemical behaviour of uranium and other elements, firstly in the primary environment of the basement rocks, secondly in the hydrological environment characterizing the subsurface waters, and finally in the epigenetic

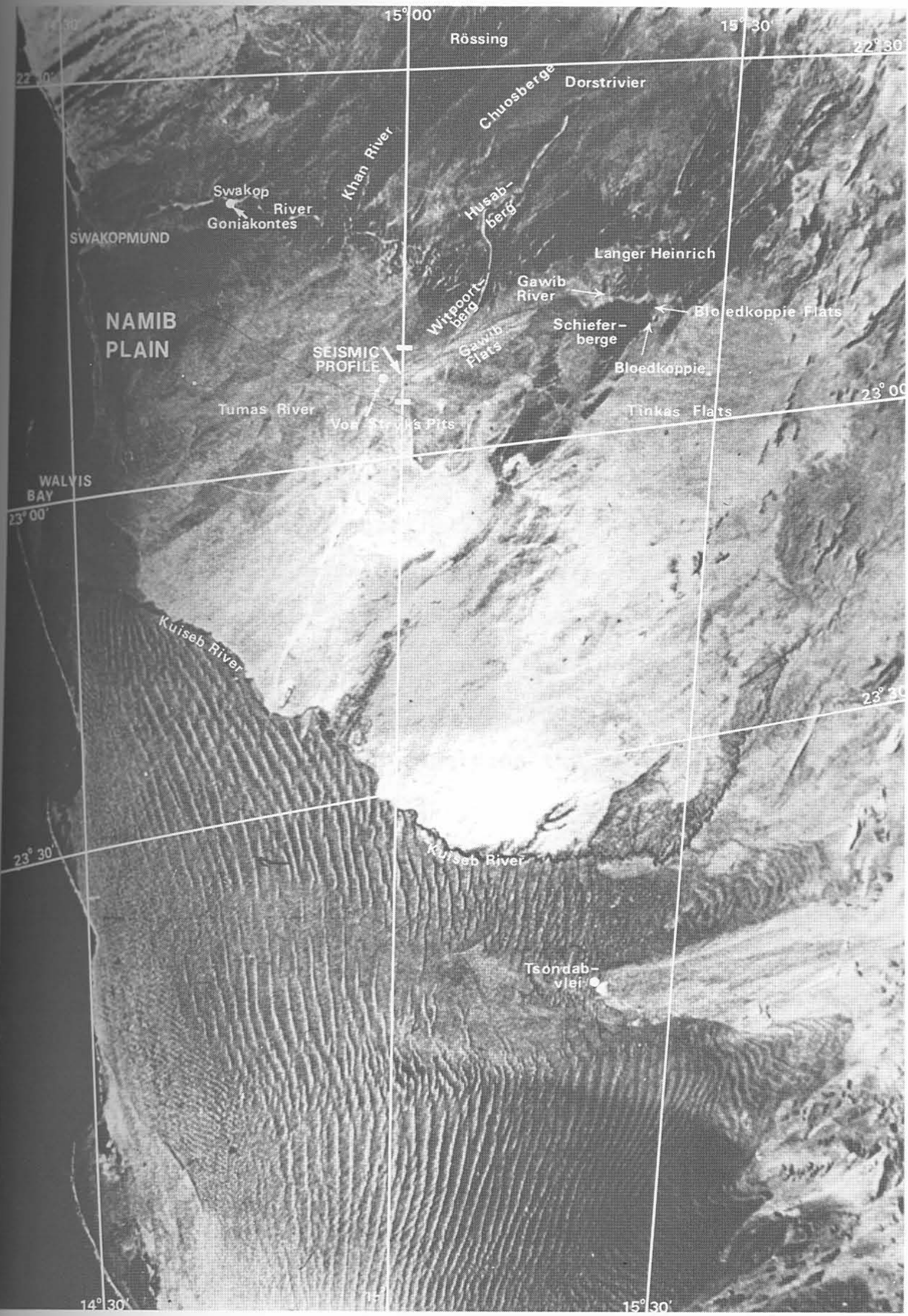

FIG 1 Gemini satellite photograph showing the areas included within this study. Approximate scale 1:800 000 *(Courtesy U S Information Service)*

environment of superficial rocks and diatomaceous muds.

The work was concentrated mainly around the Langer Heinrich uranium deposit, as this was the first major discovery of its kind in Southern Africa. It was the only area mapped in detail for this investigation. The geology of the remaining areas was obtained from maps supplied by Anglo American Prospecting Co. Ltd in their annual prospecting reports submitted to the Atomic Energy Board. (Annual Prospecting Reports, 1972, 1973, Prospecting Grant M46/3/209; Annual Prospecting Report, 1974, Prospecting Grant M46/3/430; Annual Prospecting Report, 1974, Prospecting Grant M46/3/433; Annual Prospecting Report, 1974, Prospecting Grant M46/3/487.)

The Langer Heinrich area was mapped directly onto aerial photographs at a scale of 1:36 000, from which the data was transferred to 1:25 000 topographical maps (Map 1). Some of the information regarding the basement rocks was compiled from Jacob (1974).

Whole-rock, powder, diatomaceous mud and water samples were collected. At the Langer Heinrich, only surface whole-rock samples of calcrete were taken, as no borehole cores were available at that time. Powder samples of calcrete from the percussion drilling program were readily available. Four boreholes were drilled specifi= cally for this investigation and were numbered HJ1, HJ2, J1 and AD1. Samples from borehole C5, not specifically drilled for this purpose, were also used. The localities of all five boreholes are shown in Map 1. The powder samples are representative of every half-metre in depth. With percussion drilling it was not possible to obtain a sample from an exact depth, and any analytical value is therefore the mean for the half-metre it comprises.

Hand specimens of the basement rocks were obtained from the localities shown in Map 1. Each sample number was designated with the prefix LH.

Most of the water samples were obtained north of the Swakop River. The localities are given in Fig. 41. These samples were taken from existing farm boreholes by the Department of Water Affairs in Windhoek at the request of the Atomic Energy Board. Only two water samples, numbers 30 and 31, were obtained from boreholes HJ1 and J1 respec= tively at the Langer Heinrich, due to the lack of suitable equipment.

Diatomaceous muds were obtained from two cores, SWA 30 and SWA 50, supplied by Union Corp. Ltd. The localities are shown in Fig. 15. Representative samples were prepared from approximately 500 mm sections of core SWA 30, and 1 000 mm sections of core SWA 50.

Thin sections were prepared from most samples. Polished sections, impregnated with plastic, were made from selected calcrete samples. Certain whole-rock samples were analyzed by X-ray diffraction. Heavy minerals were separated from calcretes and basement rocks by heavy media using tetrabromoethane (SG = 2,98) and the Franz Isodynamic Separator. All concentrations were analyzed microscopically and by X-ray diffraction.

Approximately 50 calcrete samples from percussion boreholes were submitted for multi-element determinations by emission spectrograph.

For the analytical techniques used refer to Part II.