

I. INTRODUCTION

The first diamond discovery in the Lichtenburg area took place in 1921 on Klipbankfontein 26 IP (near Manana) while in 1926 economic quantities of diamonds were located on the farm Grasfontein 356 JP.

The diamondiferous gravels occur over an area approximately 60 kilometres long and some 50 kilometres wide (fig. 1) and are concentrated in so-called runs usually about 150 to 200 metres wide. However, gravels are also found in potholes, pans and larger surface depressions. Very high concentrations of diamonds were commonly found in potholes. (The term pothole applies throughout the text to structures that represent palaeo-sinkholes and yama's subsequently filled with gravel).

Between 1926 and 1947 the production of the Lichtenburg diggings amounted to 7 220 847 carats which was then valued at £16 006 832 (Du Toit, 1951). As the price of diamonds during this period was very much influenced by (a), the enormous quantities which reached the market, (b) the 1930 depression and (c) the events which led to World War II, it would be very difficult to estimate the value of the total diamond production at present prices, but it would obviously be significantly more in view of subsequent price increases. The annual output at present is only a few hundred carats and is minimal compared with the early years when digging operations were in full swing.

The proclamation of these diamond fields in 1926 led to one of the biggest diamond rushes in South Africa. It was estimated that nearly 50 000 white diggers and some 90 000 black helpers were concentrated in the Bakerville area at the beginning of 1929 (Von Backström and others, 1953, p.36).

At present only a handful of diggers are exploiting the gravel by means of very simple mining methods and they generally lack the scientific knowledge and financial resources to make a proper assessment

of the remaining potential of the gravels.

In view of the great economic potential of further discoveries of gravel-filled potholes, it was decided to do an intensive investigation of the diamondiferous gravels of the Lichtenburg district. The Lichtenburg area has already been extensively studied geologically by Draper (1927), Du Toit (1951), Retief (1960) and Darracott (1973, 1974). In order to extend the existing geological information a detailed geophysical investigation of the area was planned. Initially two test areas on the farms Grasfontein 356 JP and Ruigtelaagte 353 JP measuring 7 and 7,5 km² respectively, were investigated (fig.1). The test areas are 10 kilometres apart and potholes, famed for their high diamond content are known to occur in both. The former area was investigated by the author and the latter by Stettler (1979) (fig. 1).

Detailed gravity and magnetic surveys were conducted on a 50-metre grid on the farm Grasfontein 356 JP. This was later followed by a drilling programme. Special attention was given to the existence of potholes. The field work was started in February 1977 and was completed one year later, apart from electromagnetic surveys conducted by Stettler (1979).

The Grasfontein area includes King's and Malan's potholes, both famous for their richness in diamonds. According to Du Toit (1951), of the 7 220 847 carats which were extracted from all the gravels around Lichtenburg between 1926 and 1947, a total of 2 309 156 carats (nearly 32 per cent) then worth £4 981 950, was found on Grasfontein 356 JP only.

The author wishes to express his sincere thanks to the Director of the Geological Survey of South Africa for permission to use the information obtained during the investigation for this thesis.

Thanks are due to Prof. C.P. Snyman and Dr R.J. Kleywegt for their supervision and guidance during the course of this work.

I have enjoyed useful discussions with Mr J.B. Hawthorne, Dr M.J. de Wit, Dr E. Martini, Mr E.H. Stettler and Mr E. Bredenkamp, a local digger from Bakerville. The assistance and advice of Mr J.H.T. Beukes, Mr G.F. Filmalter and Dr D. Henthorn are acknowledged.

Thanks are due to the Anglo American Research Laboratory for the microprobe analysis of certain grains, and to Mr T. Hattingh of the University of the Orange Free State for his help and guidance with the interpretation of the magnetic anomalies.

Lastly I would like to thank my wife Cheryl for the patience she had during the late nights which were necessary for the completion of this thesis.