Prehistoric mining in South Africa, and Iron Age copper mines in the Dwarsberg, Transvaal

by R. J. MASON*, Ph.D., B.Com.

SYNOPSIS

The paper discusses the claim that the remains of mines in Southern Africa date from ancient times, rather than from a more modern period. The evidence indicates that these mines were excavated by Iron Age Black people, who moved into South Africa from about A.D. 100 onwards.

Details are given of the finds made in 1981 in an investigation of the remains of copper mines in the Dwarsberg, which probably date from the nineteenth century.

SAMEVATTING

Die referaat bespreek die aanspraak dat die oorblyfsels van myne in Suidelike Afrika uit die outyd eerder as uit 'n meer moderne periode dateer. Die getuienis dui daarop dat hierdie myne uitgegrawe is deur Swartmense uit die Ystertydperk wat vanaf ongeveer 100 n.C. in Suid-Afrika ingetrek het.

Besonderhede word verstrek van vondse wat in 1981 gedoen is tydens 'n ondersoek van die oorblyfsels van kopermyne in die Dwarsberg wat waarskynlik uit die negentiende eeu dateer.

Introduction

There are at least three distinct periods in the scientific investigation of prehistoric mining and metal production in South Africa.

The first period relates to nineteenth-century explorers such as Baines, who recorded holes dug by indigenous peoples for iron ore in the Yzerberg, near Pietersburg (cited by Friede[1], see Fig. 1).

The second period concerns pioneer geologists such as Wagner, who collected substantial data on prehistoric metal production in the pioneer period of South African archaeology before 1930.

The third period started in the 1960s, when the interest of professional archaeologists in the South African Iron Age was aroused. Friede's 1980 analysis[1], which gives a bibliography of 35 publications that in turn refer to others, provides an accurate review of the substantial mass of new field work and laboratory work on Iron Age mining and metal production conducted between 1964 and 1980.

Writing in the 1920s, Wagner[1] stated that two distinct traditions were responsible for prehistoric mining in

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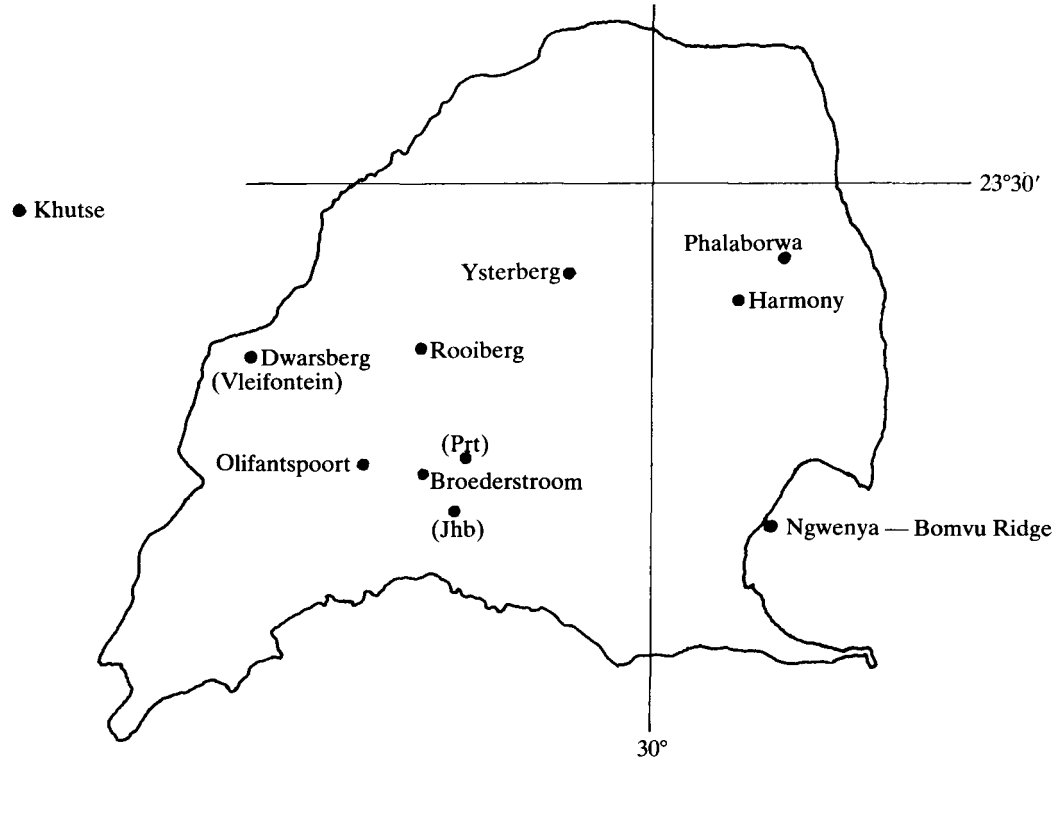

Fig. 1—The location of the sites referred to in the text

Southern Africa. He identified prehistoric mining as 'ancient mining', and detected a really 'ancient' tradition and a 'more modern' tradition related to 'present day natives and their predecessors'.

Between 1964 and 1982, a number of archaeologists devoted their attention to the problem of prehistoric mining in South Africa. Mason[2], in 1964, investigated smelting and living sites related to copper mining at Phalaborwa (Fig. 1). The following year, Van der Merwe[3] began work at Phalaborwa, and Dart, Beaumont, and Boshier commenced their investigations at Bomvu Ridge, in Swaziland. In 1969 the latter three transferred their attention to Postmasburg in the northern Cape[4–6] (Fig. 1). They were inspired by Wagner's belief that a 'really ancient' tradition was responsible for some of the prehistoric mining. Evers[7], Van der Merwe, Hall[8], and Mason related the Phalaborwa, Rooiberg, Harmony, and Vleifontein mines to the South African Iron Age, which is the technological tradition of the Black people in South Africa, whom Wagner would have identified as 'present day natives and their predecessors'.

The present paper discusses the evidence for 'a really ancient tradition' and a 'more modern tradition' in South African prehistoric mining. Dart, Beaumont, and Boshier's work at Bomvu Ridge and Postmasburg (Fig. 1) is examined for evidence of the really ancient tradition, and work at Harmony, Phalaborwa, and Vleifontein is presented as evidence of the Iron Age tradition.

Fig. 2—Mokgalagadi woman digging for deep-buried bulb at Khutse Pan, Botswana, 1970

The Earliest Mines and Mining Tools

Man's use of materials in the earth's crust started many millions of years ago, when he became the first animal to develop a dependence on the complex manipulation of natural materials. Succeeding generations communicated this complex manipulation to descending generations. For millions of years man dug in the South African soil for edible bulbs and roots, and hunted a variety of animals nesting in tunnels burrowed under the surface soil. In South Africa the excavation of minerals (for body and wall paint) and metals followed the more ancient bulb-digging techniques and tunnelling methods used for the hunting of underground game (Fig. 2).

Minerals suitable for the making of body and wall paint are common in the Stone Age deposits of South Africa. In 1953 Mason found a variety of both yellow and red mineral fragments among the accumulations in the Cave of Hearths, which date from the Middle Stone Age. Again, in 1954 he discovered a similar Middle Stone Age accumulation much further to the west, near the Botswana border at Olieboompoort Cave[9]. The Middle Stone Age people at Olieboompoort left behind beautifully shaped hematite 'pencils' (Fig. 3). The British Museum Radiocarbon Laboratory provided the first indication of the great age of the African Middle Stone Age when, in 1955, the laboratory dated the Olieboompoort Cave Middle Stone Age at over 33 000 B.C. The hematite fragments at Olieboompoort, which were probably used to paint the skins of Middle Stone Age people, were probably collected from the surface near the cave entrance. Stone artefacts similar to the Lion

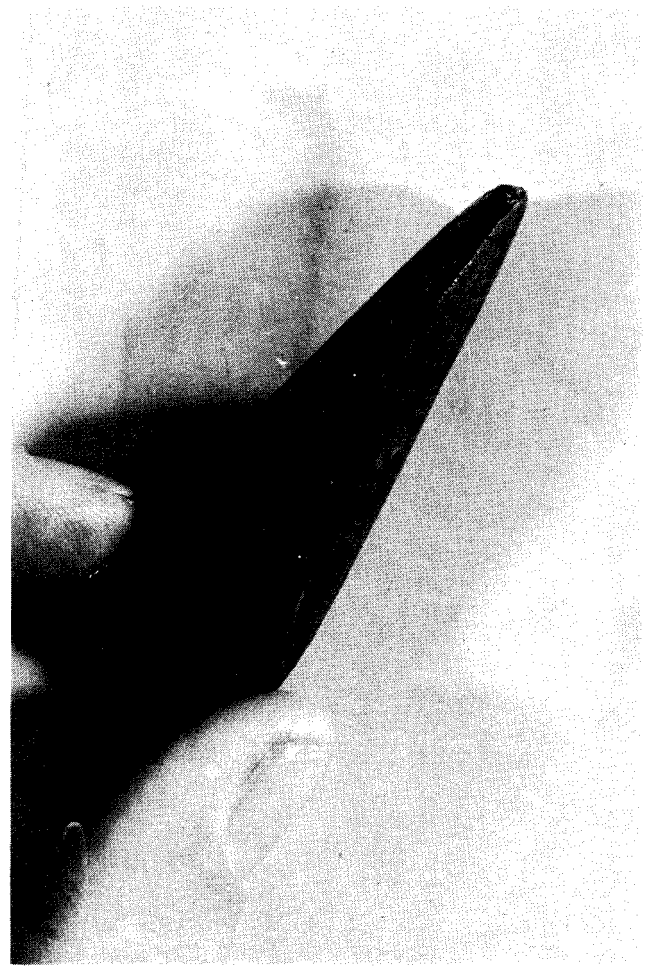

Fig. 3—Hematite 'pencil' ground for colour by Middle Stone Age people at Olieboompoort Cave over 33 000 years ago

Cavern 'mining tools'[5] lie in the Olieboompoort Middle Stone Age deposit, but there is no trace of 'mining' in the vicinity. The Olieboompoort tools were probably used for cracking bones for food.

Claims of 'Ancient' Mining

In the 1960s, Dart, Beaumont, and Boshier became interested in the relationship between the minerals used in Africa for colouring purposes and mining. Nineteenth-century records show that the Black people used two methods for finding minerals. They obtained them from the surface, and they mined them by actually making holes in the surface of the earth. Beaumont and Boshier, who at that time were acting as field officers for Dart, examined these records very thoroughly, and between 1964 and 1967 they conducted archaeological investigations at Bomvu Ridge in western Swaziland[4-6] before proceeding to Postmasburg, in the northern Cape. At the Lion Cave site at Bomvu Ridge, they made observations that led them to believe that actual mining had started in South Africa during the Middle Stone Age tens of thousands of years ago. At Lion Cavern, Dart and Beaumont[10] claimed that 'mined bedrock' was revealed at a depth of 11ft and in the 8ft to 11ft level 23000 artefacts belonging unquestionably to a middle stage of Middle Stone Age were recovered. Carbon from different parts of this bedrock stratum was sent to both the Yale and Groningen Laboratories. Their two datings were Y-1827 22 280 ± 400 BP, and GrN 5620 28 130 ± 260 BP.

Dart and Beaumont went on to claim that 'as the *worked floor* supporting this deposit extends outwards for at least a further 10 ft it would be premature to imagine that the 29th millenium BP date is the earliest for mining obtainable at this site'. Indeed, their subsequent trench into this deposit gave a date of 43 200 ± 1600 BP (GrN5313)[5]. Dart and Beaumont[4] record that 'stone mining tools' were found in the 8 ft to 11 ft basal Middle Stone Age assemblage at Lion Cavern[2]. However, no detailed analyses of 'worked', 'gouged', or 'mined bedrock' were given; nor were edgewear analyses of the 'stone mining tools'.

A good example of edgewear analysis is that conducted by Binneman[11], who based his analysis of South African artefacts on methods used in Europe for over twenty years.

Until thorough studies have been made of the 'worked surfaces' at Lion Cavern it must be assumed that the hematite surfaces supporting the Swaziland Stone Age deposits are natural surfaces or surfaces modified by

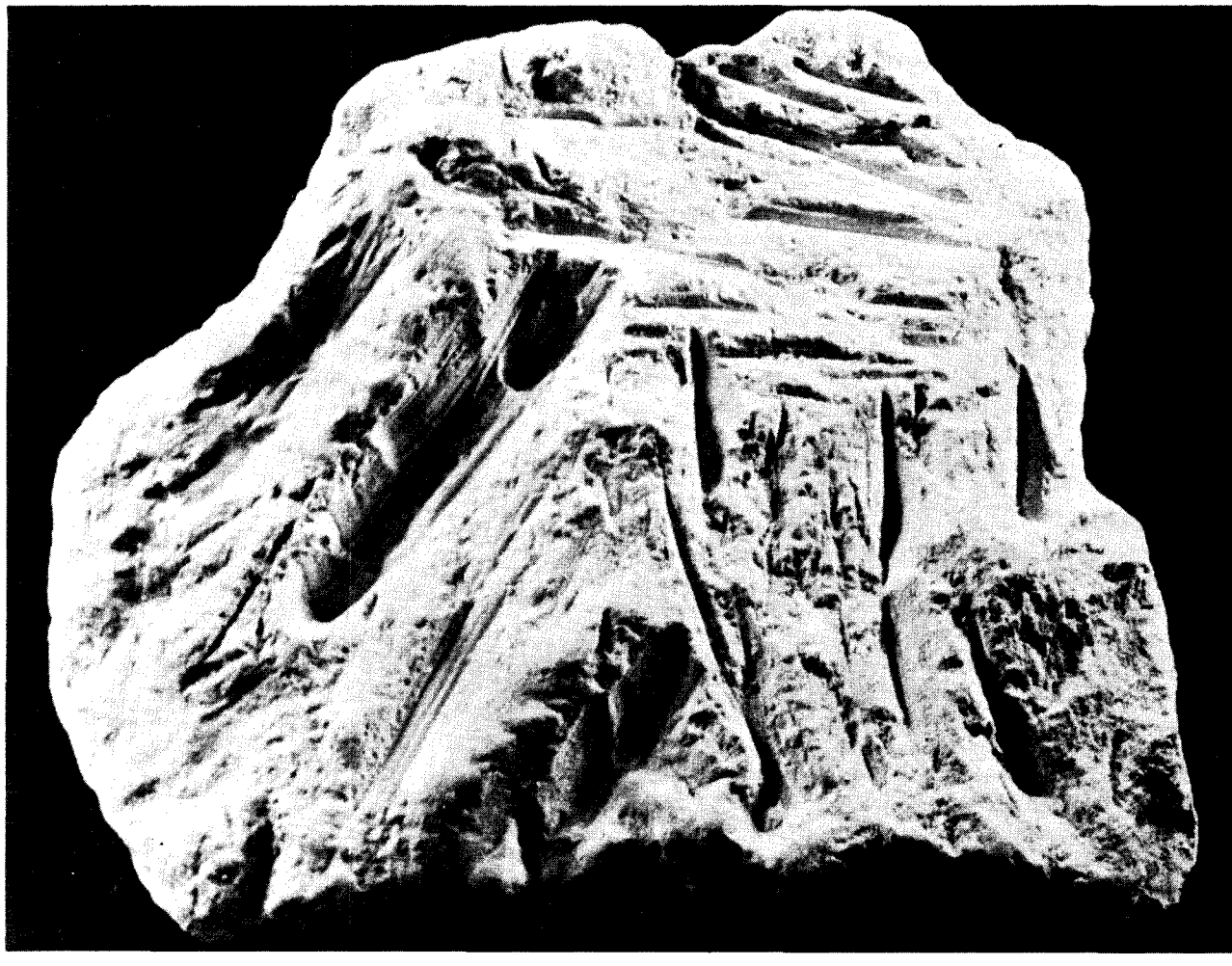

Fig. 4—Chalk block from Neolithic flint mine at Spiennes, western Europe, showing pick impressions. (From Shepherd[12], by permission of the Publisher)

shallow excavation similar to that practised by a modern hunter-gatherer of roots, bulbs, and springhares. It cannot be claimed that modern San are *mining* for bulbs, nor that 'mining' started tens of thousands of years ago in Swaziland. Such a claim would require detailed plans and profiles of the Swaziland sites and photographs of Swaziland 'mined' surfaces similar to the remarkable photograph of the cavities made by flint picks in a Neolithic chalk block from Spiennes, near Mons in Western Europe[12] (Fig. 4). The hematite occurrences in Swaziland require studies similar to the methods used at European sites, which Shepherd[12] describes with great clarity. Until this is done, the earliest acceptable date in South Africa for an Iron Age mine is A.D. 770 ±80. This relates to a shaft 20 ft deep with a 30 ft gallery at Phalaborwa, which was investigated by Van der Merwe in 1965. A deposit of charcoal on the gallery floor, presumably the result of fire-setting, provided the material for the radiocarbon dating of 770 ±80 A.D. (Y-1636)[3].

There is no doubt at all that the shafts and galleries investigated by Van der Merwe and many others at similar Iron Age mines represent true mining activities. But no support can be given to Dart and Beaumont's claim that the surfaces supporting their Middle Stone Age deposits at Bomvu Ridge were surfaces exposed by deliberate excavation of the Bomvu Ridge orebody.

Evidence for 'More Modern' Mining

From around A.D. 770 onwards, many dozens of mines that are represented by vertical or inclined shafts with galleries leading off them cut into solid rock, and therefore representing true mining, have been excavated by modern archaeological techniques in Southern Africa. Examples are the finds of Van der Merwe and Scully[3] in 1971, Evers[7] at Harmony, eastern Transvaal, in 1974, Steel[13] at Olifantspoort, near Rustenburg, in 1973, and the close surface observations made at Vleifontein by Mason in 1981. The specularite galleries at Postmasburg[14] produced charcoal from rubble on the floor of a specularite stope or gallery. The rubble contained stone artefacts and other materials and charcoal dated to circa A.D. 830 (PTA 186 & PTA 187). Mason's excavations of Late Stone Age deposits at Olieboompoort Cave and at Munro's Site[15], east of Postmasburg, prove that the Stone Age lasted until well into the second millenium A.D. Therefore, the finding of Stone Age artefacts in the tunnels of Postmasburg does not necessarily mean that Stone Age people actually excavated those tunnels. The stone artefacts could have been left in the tunnels by Stone Age people using these tunnels as a refuge. The tunnels themselves were probably excavated by Iron Age people using mining techniques similar to the Iron Age techniques revealed at Phalaborwa and at deep-level mining sites of Iron Age date such as Rooiberg[1, 8].

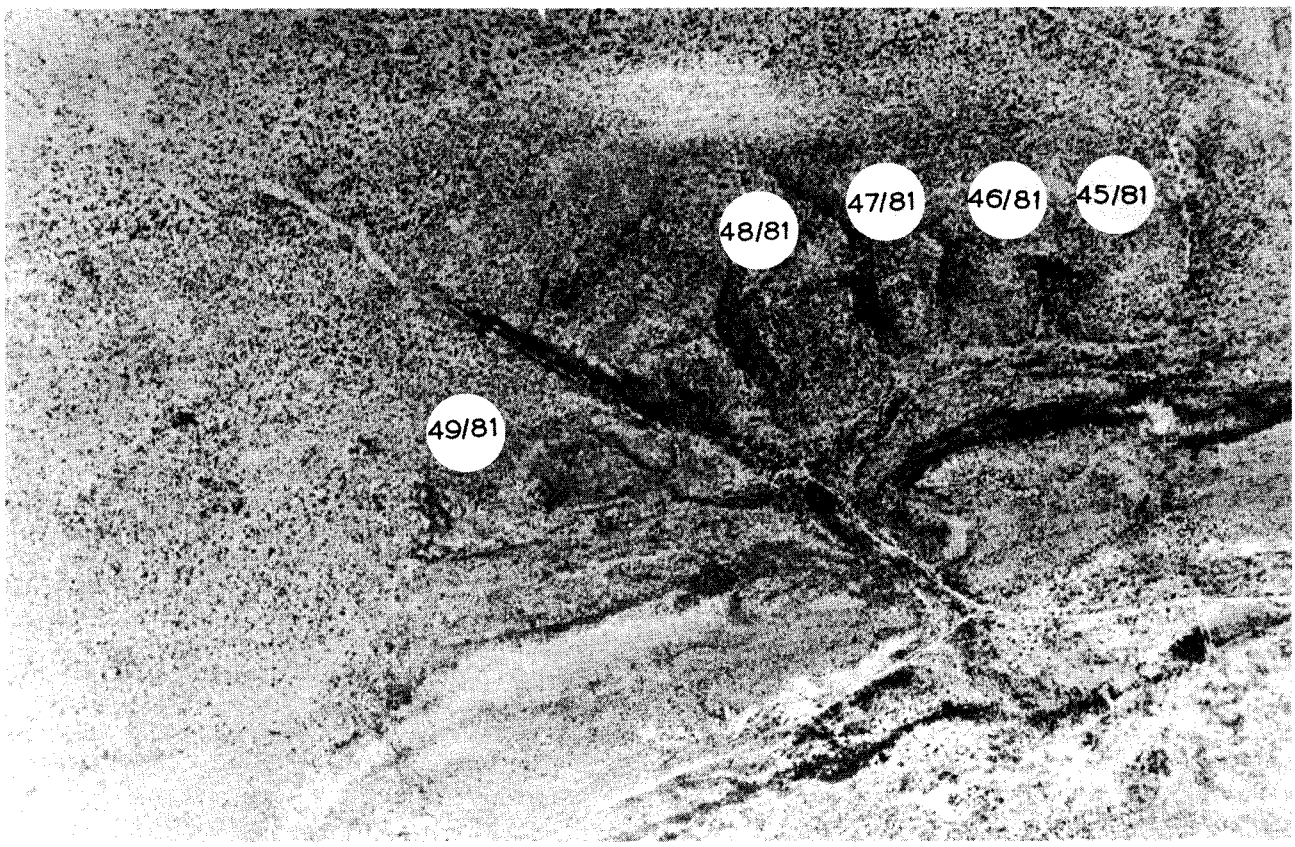

Fig. 5—Vleifontein area of Dwarsberg, Transvaal, showing the distribution of the Iron Age copper mines 45-49/81 (from airphoto no. 2388, job 694, by permission of the Department of Community Development)

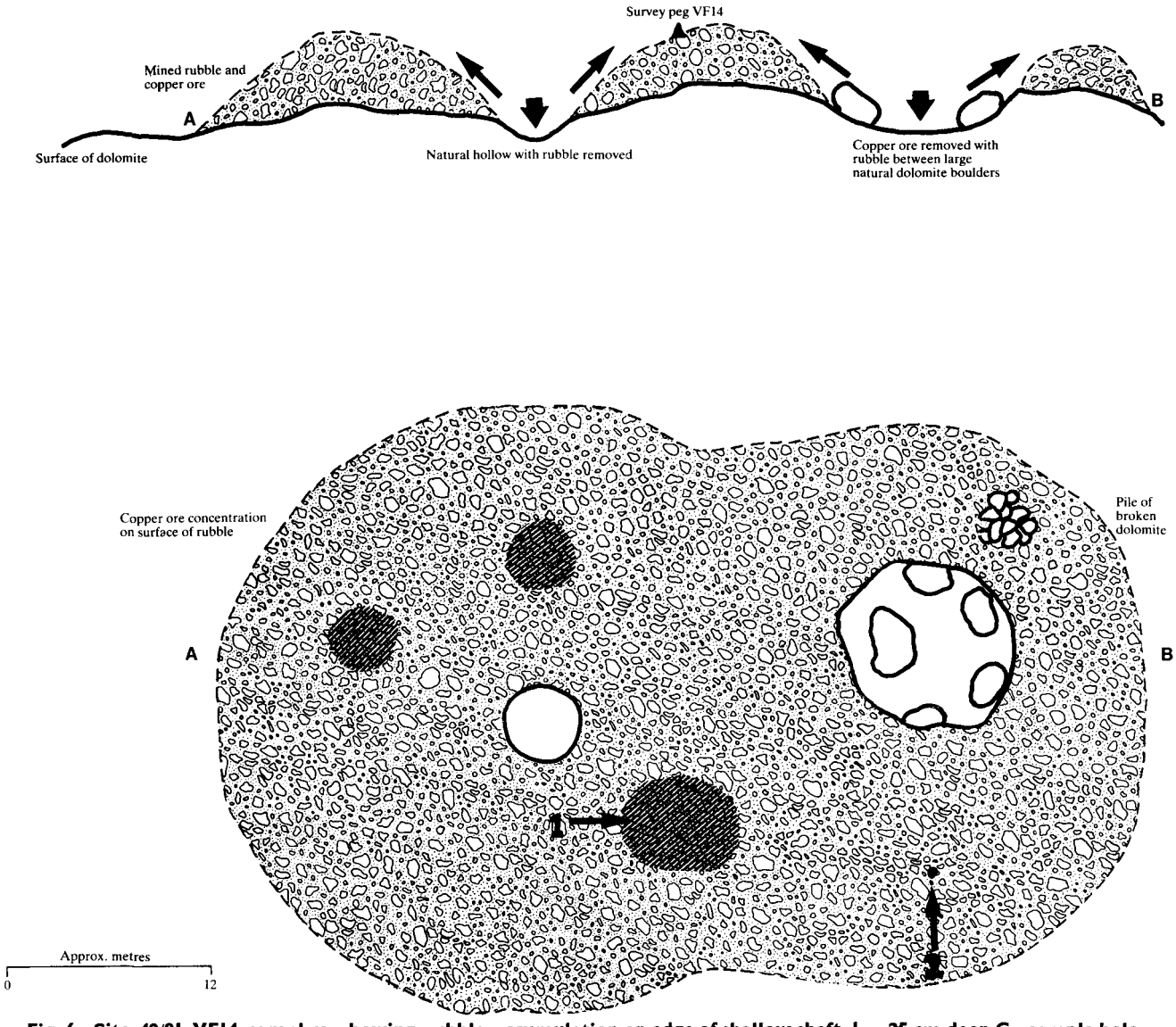

Fig. 6—Site 49/81 VF14 complex, showing rubble accumulation on edge of shallow shaft. 1 = 25 cm deep C_{14} sample hole, 2 = Dolorite cuboid (hammer?)

Iron Age people, introducing a farming economy and a village-based society, moved into South Africa from circa A.D. 100 onwards. At places such as Broederstroom, where the settlement dates from A.D. 350 to 600[16], these Iron Age people acquired iron ore for smelting by collecting the iron ore exposed by soil erosion at sites such as the deep erosion gulley on the south-west edge of the Broederstroom Early Iron Age site. Copper ore collected from the surface may have been the source of the copper artefacts found in the Broederstroom deposit[1].

Mining as an exercise involving the sinking of shafts and galleries into solid rock probably did not develop until populations had increased to a point where specialist mining activity became both possible and profitable. Phalaborwa has the earliest example of a shaft and gallery cutting through solid rock (A.D. 770); the specularite galleries at Postmasburg represent the next earliest example. These were followed by the stopes and shafts observed by Evers[7] at Harmony Block, where he collected one sample of charcoal from the tailings or rubble excavated at Unit 8 Site 2 17/3/82, which gave a date of 1260 ±90 A.D. (RL 2070).

Some, at least, of the spectacular rock-cut stopes and shafts of the Rooiberg Mines post-date the A.D. 1550 date of a log Mason found in part of the Rooiberg galleries. (Hall[8] gives a good summary of the Rooiberg Tin complex.) The rest of the Rooiberg Mine and the mine shafts, stopes, or galleries at Vleifontein would seem to date from a period after A.D. 1550. The Iron Age population had to reach a certain minimum size before the demand for copper, tin, and iron was large enough to support the specialized mining communities suggested by the Iron Age mines at Phalaborwa, Rooiberg, Vleifontein, and elsewhere.

Research is to be conducted on the relationship between the Vleifontein mines and large Iron Age settlements such as Kaditshwene, a few days' walking to the south.

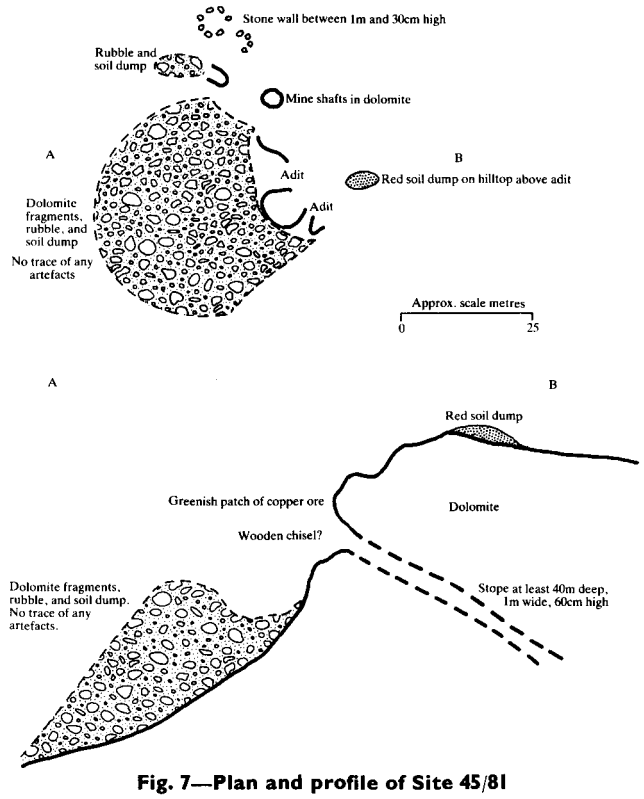

Fig. 7—Plan and profile of Site 45/81

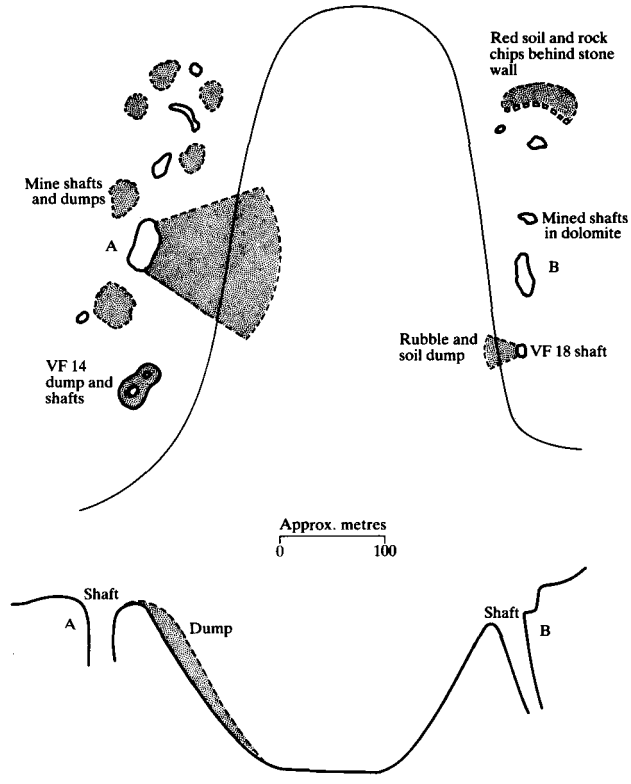

Fig. 9—Site 49/81 showing distribution of mined cavities

Copper Mines in the Dwarsberg

Wagner's papers[1] mentioned old workings in a line 50 km long from Abjaterskop westwards along the Dwarsberg to Kanfontein on the Botswana–Transvaal border. Boshier gives detailed accounts of his visit to the Dwarsberg, 'near the Botswana border'[17] (presumably Secheli's Oude Stad, west of Vleifontein and Abjaterskop). Boshier was led by a Mokgatla informant, who knew some of the Bakgatla traditions associated with the Bakgatla exploitation of the Dwarsberg copper mines in the eighteenth or early nineteenth century.

In 1981, a party led by Mason visited Vleifontein, a few kilometres west of Abjaterskop, with the kind permission of Mr J. H. Snyman, the owner of the farm. They located Iron Age copper mines at sites 45-49/81

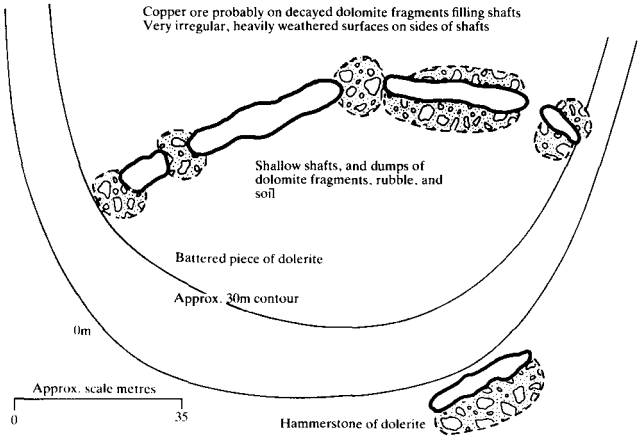

Fig. 8—Site 47/81 showing excavation of rubble from natural trenches in dolomite

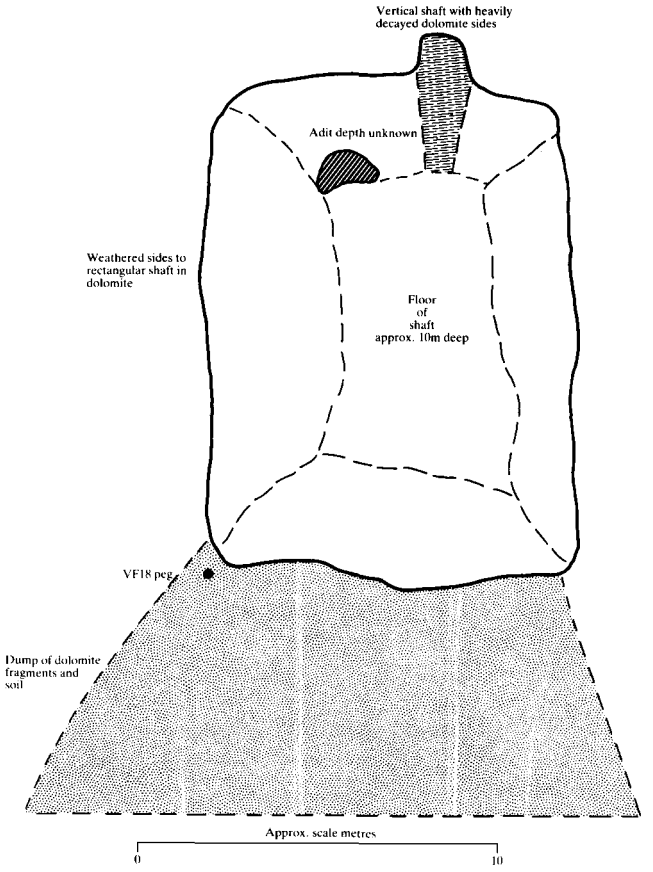

Fig. 10—Approximate plan of Site 49/81, VF18 shaft

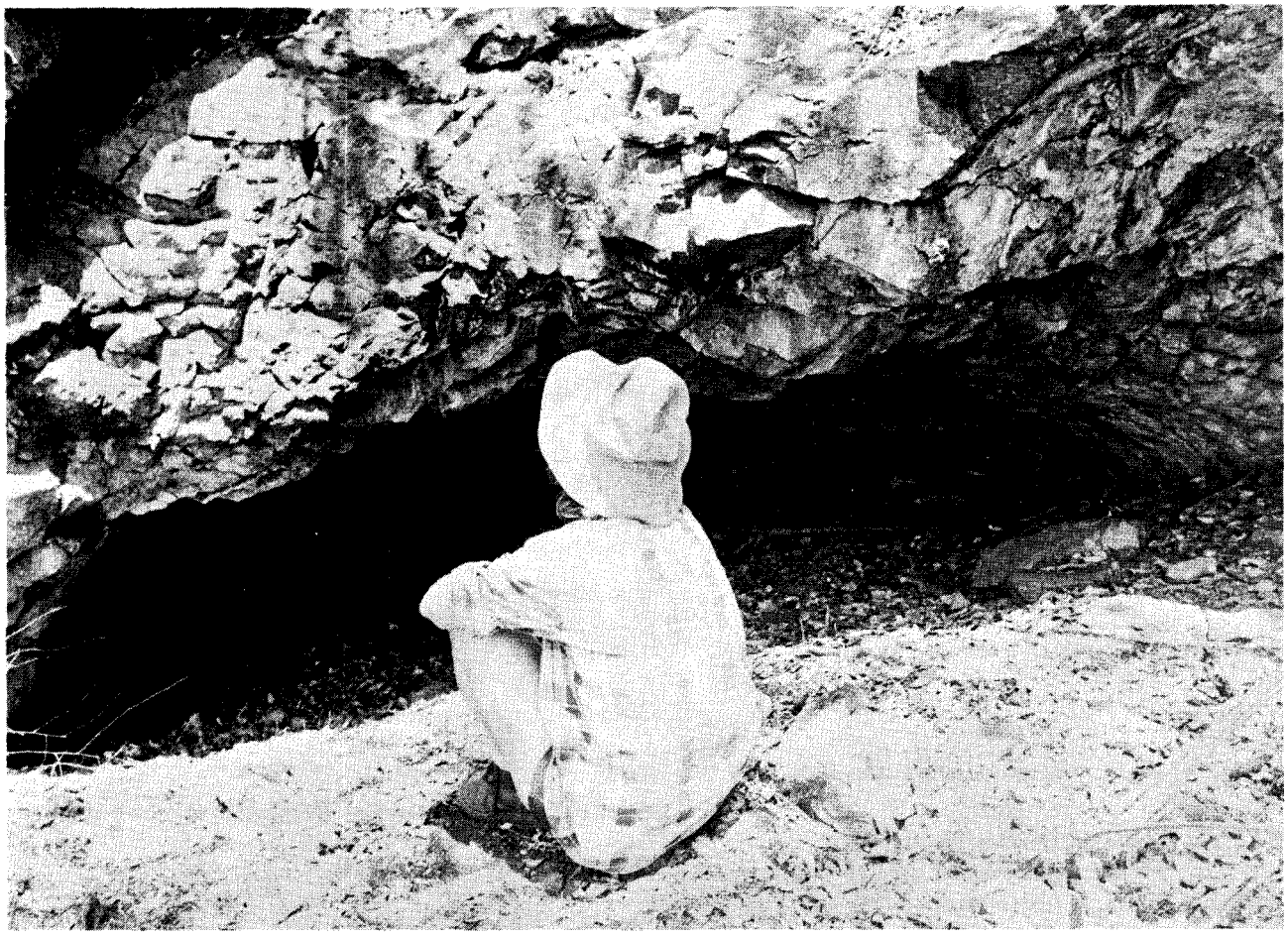

Fig. 11—Vleifontein mine adit in shattered dolomite

(Fig. 5). The dating of sites 45-49/81 is by no means definite because of the virtual absence of any artefacts of any age, prehistoric or historic. They reasoned that recent historic working of the mines would have left some nineteenth- or twentieth-century artefacts. As none were found, sites 45-49/81 are thought to be associated with Iron Age mining rather than with mining by nineteenth- or twentieth-century Whites.

The geological character of Vleifontein and its neighbouring copper mines is set out in the Addendum by Partridge, who analysed the airphotographs after the party's return from Vleifontein. He discovered 19 sites in addition to the 5 sites located by the visiting party.

The shafting and underground stopes at sites 45-49/81. are not well developed. Most of the Vleifontein Iron Age mining operations could be described as relatively shallow pitting surrounded by crater-like rubble, or trenching with most rubble dumped on the surface on either side of the trench (Fig. 6). Site 45/81 (Fig. 7) was the only one with a reasonably developed stope, at an angle of about 30 degrees for a length of about 40 m, when its height diminished to about 60 cm and its width to about 1 m.

Site 47/81 (Fig. 8) shows a group of trenches in the dolomite. The sides of the trenches are heavily weathered, suggesting that they were naturally filled with colluvial or residual rubble carrying traces of copper. Mining stopped when the natural rubble had been cleared out of the gulley.

The largest mine the Mason party visited was 49/81, which has a number of pits, trenches, and dumps (Fig. 9) covering about 500 by 500 m (Fig. 12). The largest excavation is identified by a nearby survey peg labelled VF 18 (Fig. 10). VF 18 consists of a roughly rectangular shaft about 12 by 10 m at the surface. The sides are nearly vertical for a depth of 10 m. A small adit opens into a shallow underground stope from the north-west corner of the main shaft. A narrow vertical shaft running from surface to floor lies open on the north-east corner of the main shaft. It is possible that the entire shaft was opened up by working sideways from this shaft.

The dolomite at sites 45-49/81 is not as monolithic as the Makapan Valley dolomite. The Vleifontein dolomite is riddled with fracture planes and joint planes forming slabs between 20 and 5 cm thick. (Fig. 11). These planes were probably the key to the Vleifontein copper. Some green copper stains were found on the surface dolomite. The Iron Age miners probably followed these stains into the solid rock by levering out pieces 5 to 20 cm thick, using iron levers like the Rooiberg lever[1], or possibly even hardwood digging sticks. There was no trace of fire-setting as at the Harmony site[7]. Angular rubble was dumped directly next to the shaft or stope (Figs. 12 and

Fig. 12—Angular rubble on slope below Site 45/81

13).

At 49/81 there was further evidence that the Iron Age miners had discovered ancient narrow gullies (Fig. 14) filled with heavily weathered rubble. As at site 47/81, they had followed the weathered surface on the sides of these gullies downwards for a vertical distance of 3 or 4 m, and had then stopped. Perhaps they had found enough copper in the rubble filling to make it worthwhile, or had been tempted to clear the gulley in the hopes of finding copper on its sides, but without success.

The Mason party's traverse of the Dwarsberg mining site was limited, *and they found no trace of smelting copper* and only two stone artefacts, which had apparently been used for hammering an iron chisel or battering ore. Steel found no evidence of copper smelting on the entire farm Olifantspoort surrounding the copper mine 47/73[13], although Evers found copper furnaces next to the Harmony mines[7]. However, remains of ore processing were found on the surfaces of the dumps surrounding 49/81 VF 14 (Fig. 6). Here the most prominent ore patch was 6 m in diameter (Fig. 6) and at least 30 cm deep, the green and white chips of ore standing out in marked relief against the red soil of the dump.

Conclusion

The Iron Age mines at Phalaborwa, Harmony, Doornpoort, and Rooiberg suggest that similar techniques were used at all of them. The Archaeological Research Unit has been granted a National Monuments excavation permit for the Dwarsberg mining area, and further investigations will be made as soon as possible.

The extremely fresh condition of the Vleifontein mines suggests a recent date, probably early nineteenth century. The Vleifontein data contribute to our knowledge of the skills of the Black man before White settlement, which is important in that education in South Africa desperately needs a reference to the skills of the Black man at that time. The Dwarsberg is an ideal educational environment for visits by South Africans of all ages.

Acknowledgements

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Fig. 13—Angular rubble with copper ore trace on slope below Site 45/81

Fig. 14—Iron Age miners cleared copper-bearing rubble from these ancient gullies at Site 49/81

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Addendum: Iron age copper workings in the Dwarsberg

by T. C. PARTRIDGE

The occurrences of copper mineralization that the ancient workings have exploited occur in dolomite of the upper Malmani Subgroup (Transvaal Sequence) in the north-western Transvaal. In this area the Malmani dolomite strikes in an east–west direction and dips southwards at moderate angles towards the Bushveld Basin. The mineralization appears to follow a discrete stratigraphic horizon about 500 m wide, a short distance below the top of the Malmani dolomite, which is here overlain by the Rooihoogte Formation. Within this zone

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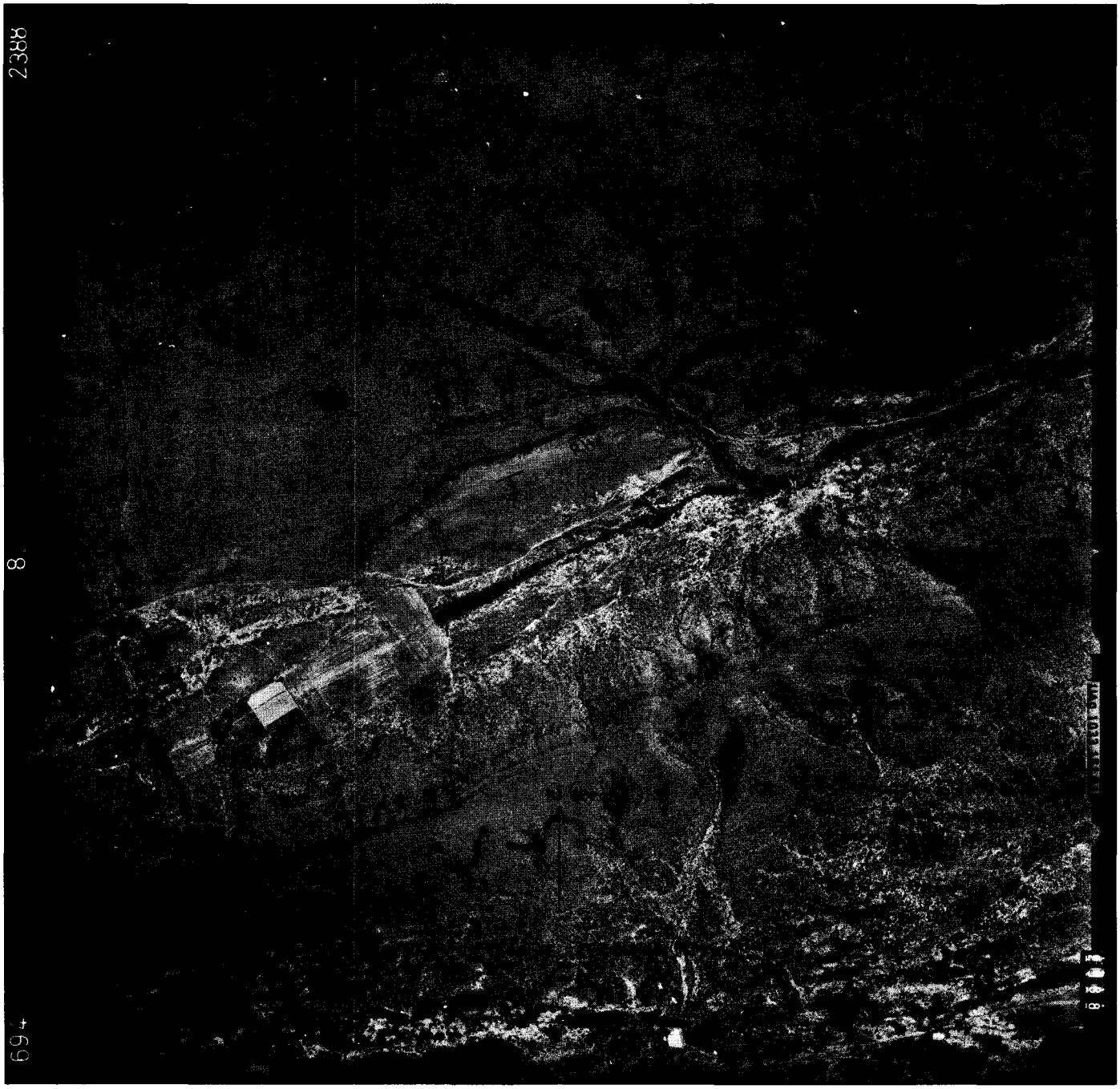

Fig. 1—Geological notes on airphoto of Vleifontein and adjacent Iron Age copper workings (airphoto reproduced under Government Printer's copyright authority No. 7797 of 20/4/82)

the occurrences of copper ore appear to be related to a number of WNW–ESE fractures, some of which have been intruded by dykes and show minor displacement. The fractures are often filled with calcite and quartz, within which malachite staining is common. Localized and disseminated occurrences of chalcopyrite, bornite, and some cuprite are also present, and it is these irregular bodies of mineralization that have been followed in the ancient workings. Copper occurrences of this type are reported to extend along strike for more than 50 km, and have been recorded on the farms Secheli's Oude Stad 6 KO, Sebenani 103 KP, Lekkerdorst 104 KP, Vleifontein 105 KP, and Abjaterskop 107 KP[1]. The copper grades are very variable, precluding systematic exploitation on a large scale.

Certain of the ancient workings in the vicinity of Vleifontein 105 have been investigated in some detail by Mason, and aerial photographs covering these occurrences were examined stereoscopically under high magnification by the writer. With a few exceptions, the workings take the form of irregular small pits whose presence is often revealed by the paler tones produced by surrounding spoil heaps. A few are more extensive (up to 150 m in diameter), and one trench was observed crossing the strike of the dolomite over a distance of about 250 m. However, this trench may be the legacy of more recent prospecting operations (Fig. 1).

All the workings are confined to a relatively narrow belt coinciding with the zone of apparent mineralization, and occur chiefly near the crests of hills, presumably because outcrops and exposures of mineralized pockets were better in these areas. In the area examined, some 25 separate workings were observed over a strike distance of about 5,5 km.

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Foundry conference

An international conference on 'Nodular iron — its metallurgical control, manufacture and application' is to be held in Johannesburg from 20th to 23rd September, 1982.

The main objective is to provide a forum for a free exchange of ideas for foundrymen, engineers, designers, and buyers of cast components. They will have the opportunity to catch up with the latest developments related to this versatile material and to obtain solutions to many of their problems. A further purpose is to promote a closer relationship between the various sectors of the engineering undustry.

The conference will be of interest to

- All foundry personnel including the marketing team
- Mining, metallurgical, mechanical engineers
- Design engineers
- Lecturers, students, and researchers
- Quality control and quality assurance officers
- End users of castings, particularly manufacturers of mining equipment, motor vehicles, and engineering products
- Companies who provide a machining service.

A distinguished panel of both local and international speakers will present papers on a wide range of subjects relating to nodular cast iron. The following topics illustrate the main subjects to be covered.

- Nodular iron development
- Process control in selected foundries
- Methoding and maximizing on casting yields
- Meehanite nodular irons
- Wear- and corrosion-resistant nodular irons
- Nodular iron as a replacement material
- Welding of nodular iron
- Nodular iron casting defects
- Nodular iron a material for the engineer
- Melting and metallurgical control of nodular iron
- Marketing and selling nodular iron castings.

All enquiries for further information should be addressed to Ted Attenborough of Meehanite Africa (Pty.) Limited, P.O. Box 6107, Dunswart. 1508. South Africa Tel.: (011) 894-2251/2; telex 8-3474.

Electrometallurgy

The annual metallurgical school of the South African Institute of Mining and Metallurgy will be held from 1st to 5th November, 1982. The topic of the school will be electrometallurgy. The S.A.I.M.M. schools provide the opportunity for engineers in industry and research to participate in short, intensive technical programmes, to encourage technical interaction between engineers engaged in similar spheres, to supply a refresher course with particular emphasis on trends and new developments, and to encourage continued familiarity with relevant current technical literature. The attendees are usually graduates with five or more years experience.

Dr V.A. Ettel, of Inco Metals, an expert in copper electrowinning and refining, will be the course leader. The other lecturers, who have been drawn from both research and plant environments, include the following: Dr M.J. Nicol, Dr R. Paul, Mr P. De Waal, Dr A.W. Bryson, Mr B. Dewar, and Miss A. Cartwright.

Further information is available from the South African Institute of Mining and Metallurgy, P.O. Box 61019, Marshalltown 2107. Telephone (011) 834-1271.