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Twenty five years of mechanisation of tabular orebodies in South African gold and platinum mines

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SUMMARY REPORT

A trackless mining operation at Cooke 2 Shaft is considered to be technically feasible.

The geology of the E8 Reef horizon in the north eastern area of Cooke 2 Shaft lease area is favourable for the introduction of trackless mining equipment. It is proposed in this area to employ the room and pillar method of mining and such a system is a proven method.

It is shown in this report that the proposed trackless operation will be considerably more efficient in the use of N.C.W.S. labour. The comparison of efficiencies for both mining systems for N.C.W.S. labour and C.W.S. labour is detailed as follows:

N.C.W.S.

	Trackless	Conventional
Labour	50	242
Tons per month	40 000	40 000
Tons/shift/N.C.W.S.	33	7

C.W.S.

Labour	20	22
Tons per month	40 000	40 000
Tons/shift/C.W.S.	83	76

The operating costs of a trackless mining operation is estimated to be R2,12 per ton less than for conventional wide reef stoping (actual estimates are R6,21 for trackless against R8,33 for conventional). The expected reduction in costs for a planned production of 40 000 tons per month is therefore in excess of R1 million per year.

The proposed trackless operation is a safe system of mining and an improvement in the accident rate can be expected.

Captial expenditure for this project must be estimated by C.P.C. Department but can be expected to be of the order of R4,9 million. The establishment of conventional wide reef stopes to produce equivalent tonnage is expected to be R1,5 million.

TECHNICAL REPORT

1. INTRODUCTION

Further to the interim report and follow-up notes to the interim report on the proposed trackless mining operation at Cooke 2 Shaft, submitted on 23rd November 1983 and 14th December 1983 respectively, this report provides for a final preliminary report for the proposed trackless operation and represents a back-up report to a R.T.S. application.

The proposed operation will be carried out on the E8 Reef horizon between 85 Level and 95 Level elevations in the north-eastern portion of the lease area of Cooke 2 shaft. In this area the E8 Reef varies in width between 2 metres and 5 metres and the general dip of the reef is between 2° and 10° in an easterly direction.

The objective of this report is to show that a mechanised trackless operation is feasible in the area proposed and that such an operation will be viable.

2. GEOLOGY

The area of the E8 Reef under consideration lies between two major faults and is invaded by the C15 and C17 dykes.

The area comprises the largest block of potentially payable E8 Reef at Cooke 2. Further, the reef in this area is relatively undisturbed and forms a fan shaped horizon dipping at between 2° and 10° to the East.

With reference to 1:10000 plan (Fig. 1) the following features are shown -

2.1 200 cms isopach.

2.2 400 cmg line.

2.3 Strike lines at 900m 950m and 1000m AMSL.

2.4 Dips.

2.5 Major faults, some of which are dyke invaded, and other minor faulted zones.

A transverse section through the N10 line is shown in Fig. 2.

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E8 REEF

1: 10 000 PLAN OF PROPOSED L.H.D. MINING AREA

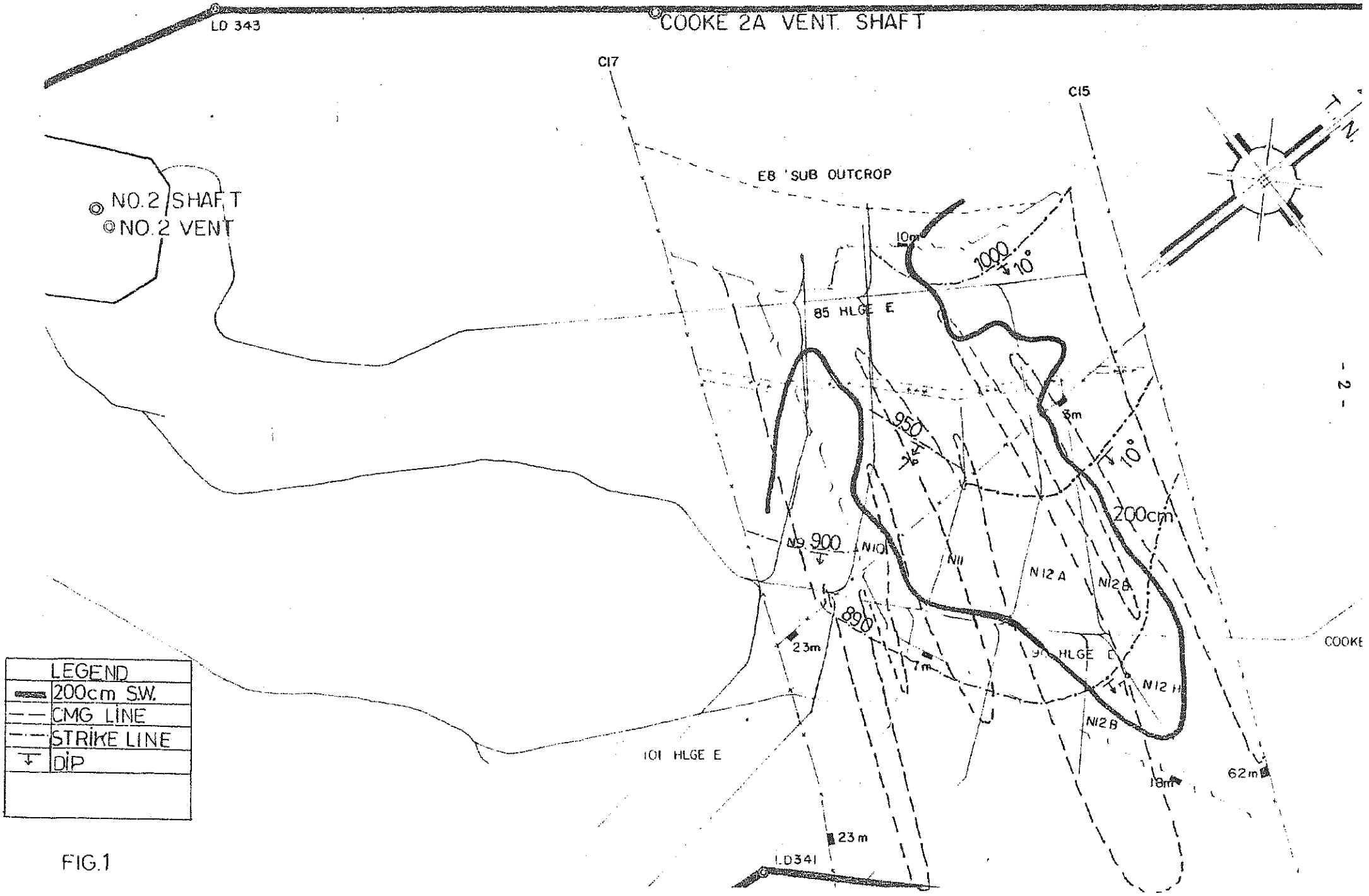


FIG.1

TRANSVERSE SECTION THROUGH NTH 10 LINE

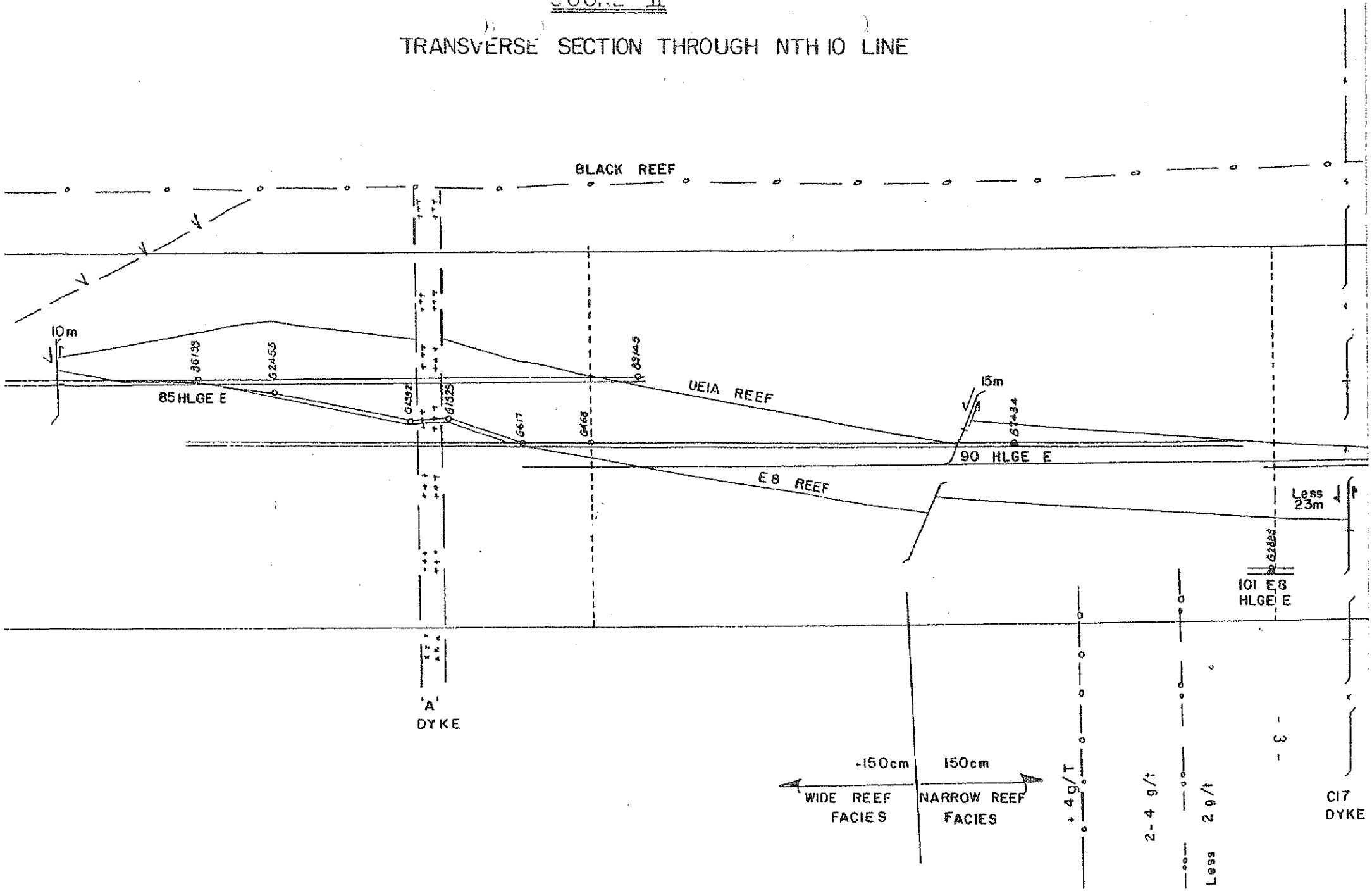


FIG. 2

3. RESERVES

The total estimated reserve on the E8 Reef horizon in the proposed area is 4,219 million tons at a value estimated to be 4,6 g/ton. This reserve is shown on Fig. 3.

The mineable reserves are therefore calculated as follows:

	Million Tons
In situ reserve (estimated)	4,219
Less area of 90 N10 stope currently being mined.	0,278
Actual in situ reserve is therefore.	3,941
Deduction for a geological loss of 10% and for loss due to regional pillars (4%).	3,389
Extraction of 90% within stopes (see section 4.4).	3,050

The actual mineable reserve is therefore estimated at 3,050 million tons at a reef width in excess of 2 metres.

4. ROCK MECHANICS CONSIDERATIONS

Certain rock mechanics recommendations have been made and these are discussed below:

4.1 Overstoping

The UE1A Reef lies 20 metres to 40 metres above the E8 Reef horizon and it is essential that maximum extraction of the UE1A Reef is achieved; the percentage extraction on the E8 Reef horizon will only be maximised if maximum extraction of the UE1A takes places. This conclusion is the result of observations in current E8 Reef stopes at Cooke 2, where a highly loaded pillar on the UE1A Reef horizon has necessitated that larger than standard pillars be left on the underlying E8 Reef horizon in order to ensure stope stability.

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E8 REEF

1:10 000 PLAN OF PROPOSED L.H.D. MINING AREA

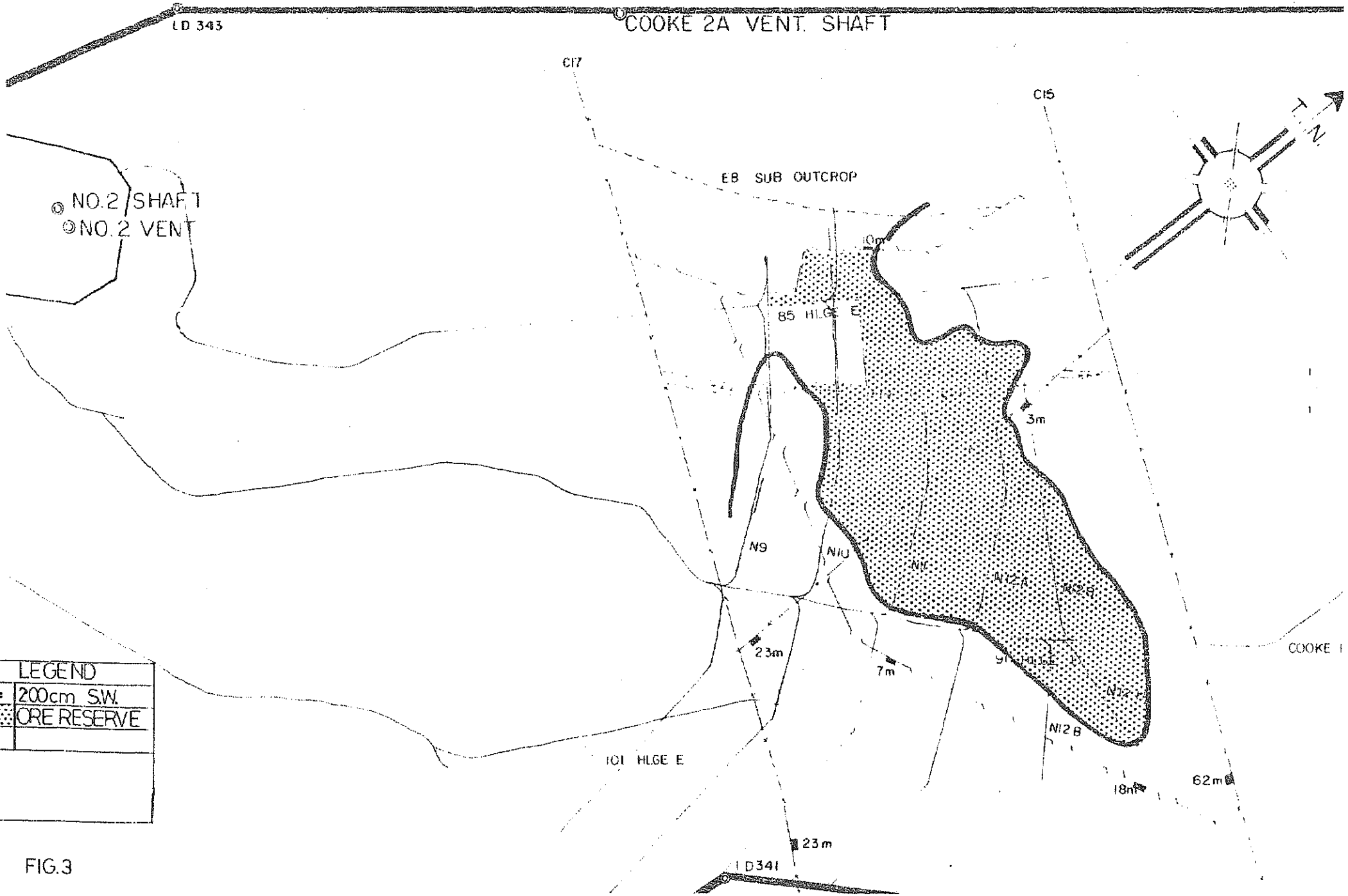


FIG.3

4.2 Regional Pillars

All regional pillars on the UE1A Reef horizon should be superimposed on identical regional pillars on the E8 Reef horizon.

4.3 Primary and Secondary Extraction

It is planned that production will take place in two stages; a sequence of primary and secondary extraction operations has definite advantages as follows:

4.3.1 The pillars initially developed in the primary operation will be larger than required and will therefore have a high factor of safety.

4.3.2 The maximum recommended bord (room) spans are 10 metres on primary mining. However, these spans can be allowed to exceed 10 metres following a secondary extraction stage on retreat when the worked out areas will then be abandoned and barricaded.

4.4 Pillar Size and Percentage Extraction

When the E8 Reef is overstoped the E8 Reef horizon will be de-stressed and consequently the pillar loads will be low. Pillars of widths of 1 to 1,5 times the stoping width will be stable and it is planned that pillar sizes on primary mining will be 7 metres x 10 metres with the final size of pillars, following a secondary extraction stage, being 5 metres x 5 metres. Final extraction is expected to be 90%. A memorandum from the Rock Mechanics Engineer dated 11 January 1984 relating to pillar sizes during primary and secondary extraction stages is in Annexure 1.

5. MINING DESIGN AND PLANNING

5.1 Production Parameters

It is envisaged that the maximum planned production from the operation will be 40 000 tons per month on a double shift basis. If it is assumed that the mineable reserve is of the order of 3 million tons as previously estimated, the life of the operation is therefore considered to be in excess of six years.

However maximum planned production is expected to be achieved during the second year of the operation (1985), the production build-up for the two year period 1984 – 1985 being shown in Schedule 1.

5.2 General Mining Layout

5.2.1 Primary Development

Development of the area will commence on 90 Level elevation. Initially contour reef drives will be developed from the 90 N11 crosscut and from these drives, decline winzes (access ramps) will be developed on true dip at approximately 150 metre centres. When a winze has holed into a bottom access airway/travellingway, stoping will commence. The general development showing contour drives and winzes is seen on Fig.4. Dimensions of the drives and declines will be 8 metres wide x 4 metres high.

5.2.2 Primary Stoping

The method of mining selected for this opration is the stepped room and pillar system. The general stoping configuration is shown in Fig.5 with the detailed layout of rooms (pillars) and pillars shown in Fig.6. Rooms will be developed at 5° down dip of true strike with access holings 60° down dip of strike being developed at 14 metre centres.

5.2.3 Secondary Extraction

Secondary extraction will be carried out when primary stoping in any winze connection is complete. During secondary extraction operations partial extraction of pillars will take place on retreat; pillars being reduced in size in stages to minimum dimensions, (refer to rock mechanics recommendations in Annexure 1). The stages in the partial extraction of pillars are shown and described in Annexure 2.

5.3 Cycle of Operations

5.3.1 Drilling and Blasting

Drilling during stoping operations will be carried out by electro-

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E8 REEF

1 10 000 PLAN OF PROPOSED L.H.D. MINING AREA

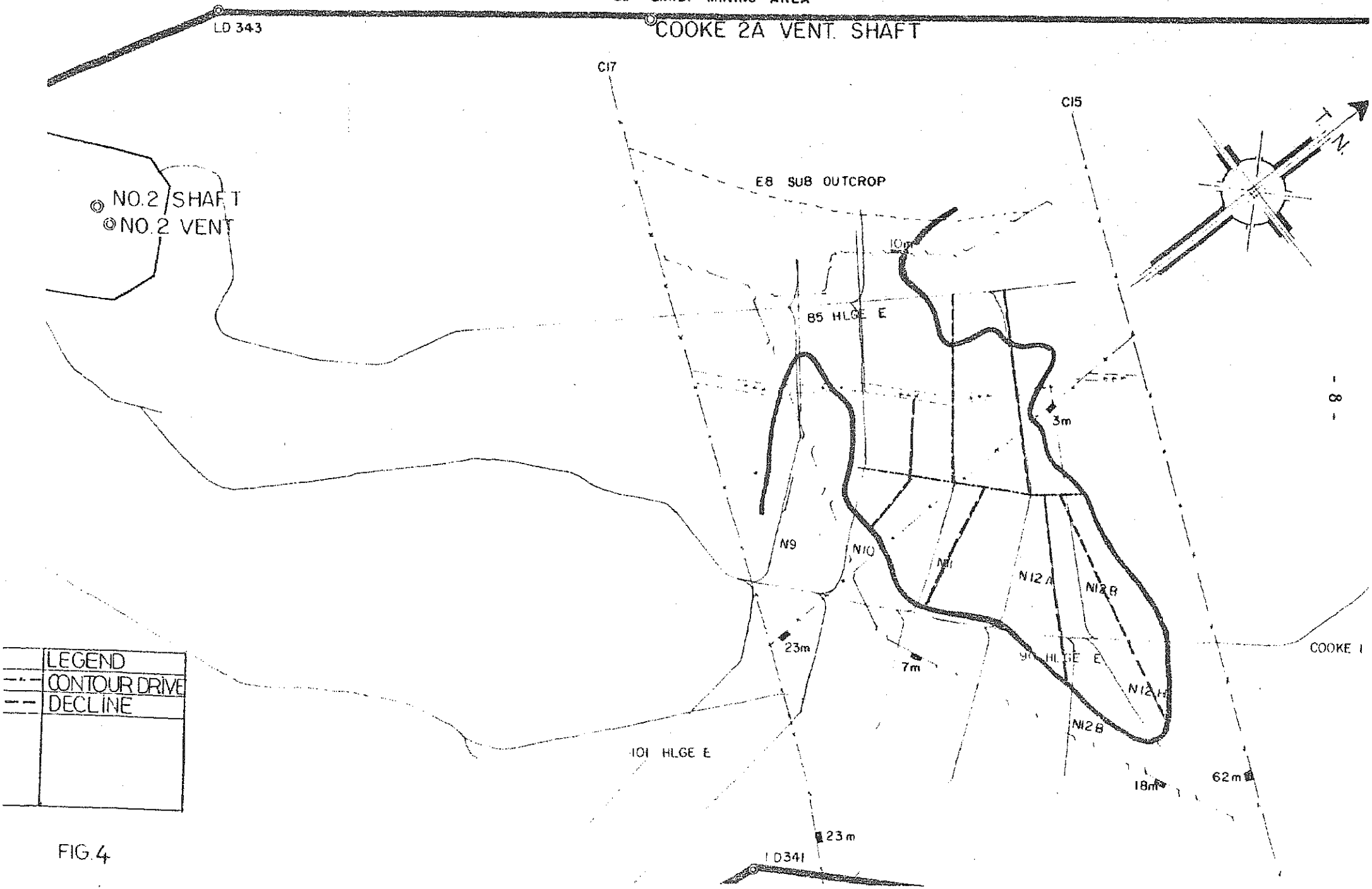
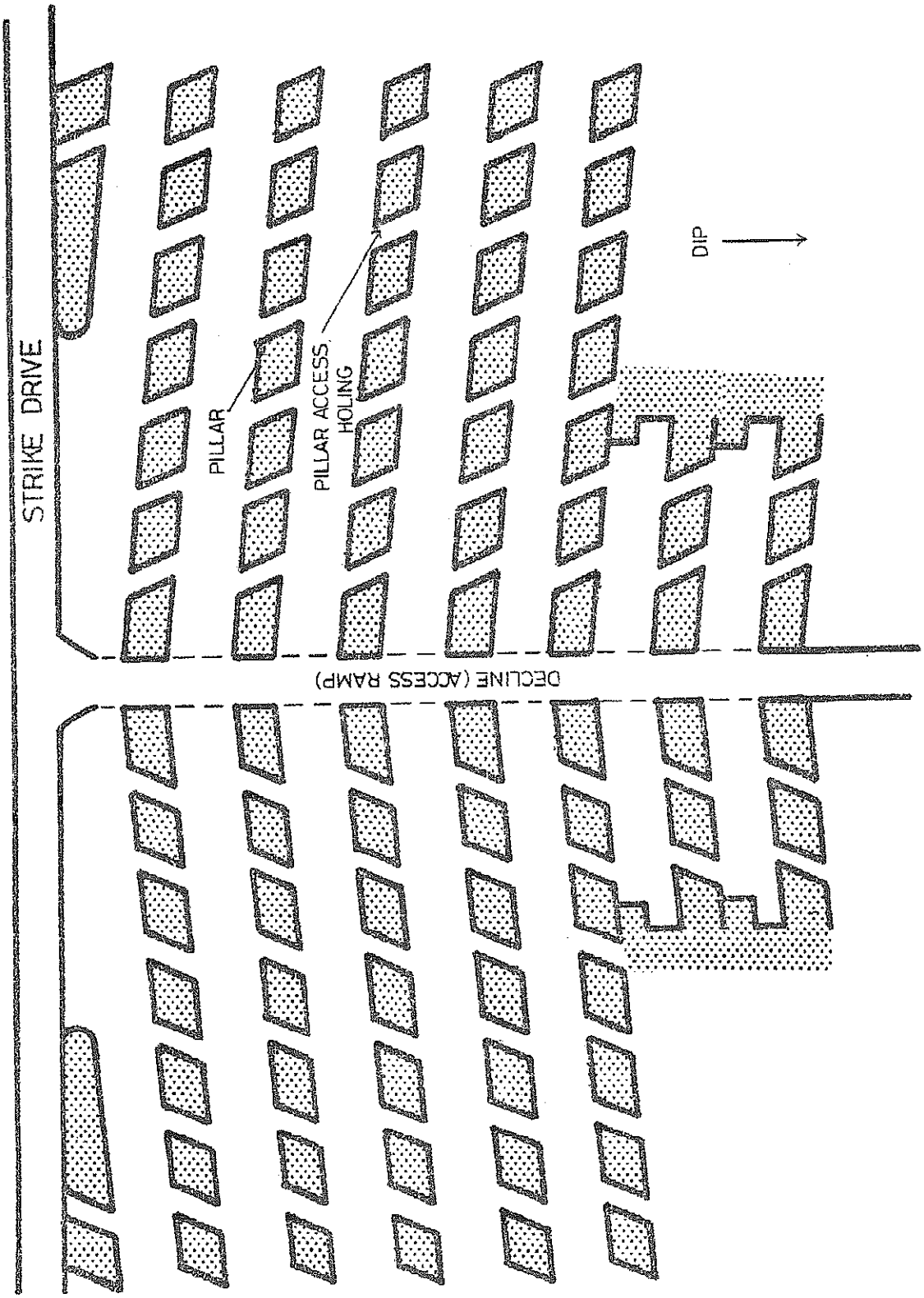


FIG. 4



TRACKLESS MINING METHOD(GENERAL STOPING CONFIGURATION)

Scale 1:1000

FIG. 5