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Sedimentological control of gold and uraninite mineralisation in the White Reef of the West Rand

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SEDIMENTOLOGICAL CONTROL OF GOLD AND URANINITE MINERALISATION IN THE WHITE REEF OF THE WEST RAND

L. S. STEYN

VOLUME II

1975

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FIGURE 1

WITWATERSRAND GOLDFIELD

WEST RAND

JOHANNESBURG

SPRINGS

FOCHVILLE

VANDER KINROSS GOLDFIELD

VEREENIGING

BALFOUR

POTCHEFSTROOM

KLERKSDORP GOLDFIELD

VREDEFORT

VILJOENSKROON

HEILBRON

FRANKFORT

BOTHAVILLE

EDENVILLE

KROONSTAD

OFS GOLDFIELD

WELKOM

FIGURE I. – LOCALITY MAP

SCALE

10 5 0 10 20 30 40 50 60 70 80 KILOMETRES

10 5 0 10 20 30 40 50 MILES

EXPLANATION

POSITION OF THE AREA INVESTIGATED IN RELATION TO THE REST OF THE WITWATERSRAND BASIN IS SHOWN.
OVERLYING, YOUNGER FORMATIONS ARE NOT INDICATED.
MAP AFTER ONE BY R. BORCHERS, 1960, WITH ADDITIONS.

MINES ON WHITE REEF SEDIMENTOLOGICALLY INVESTIGATED.

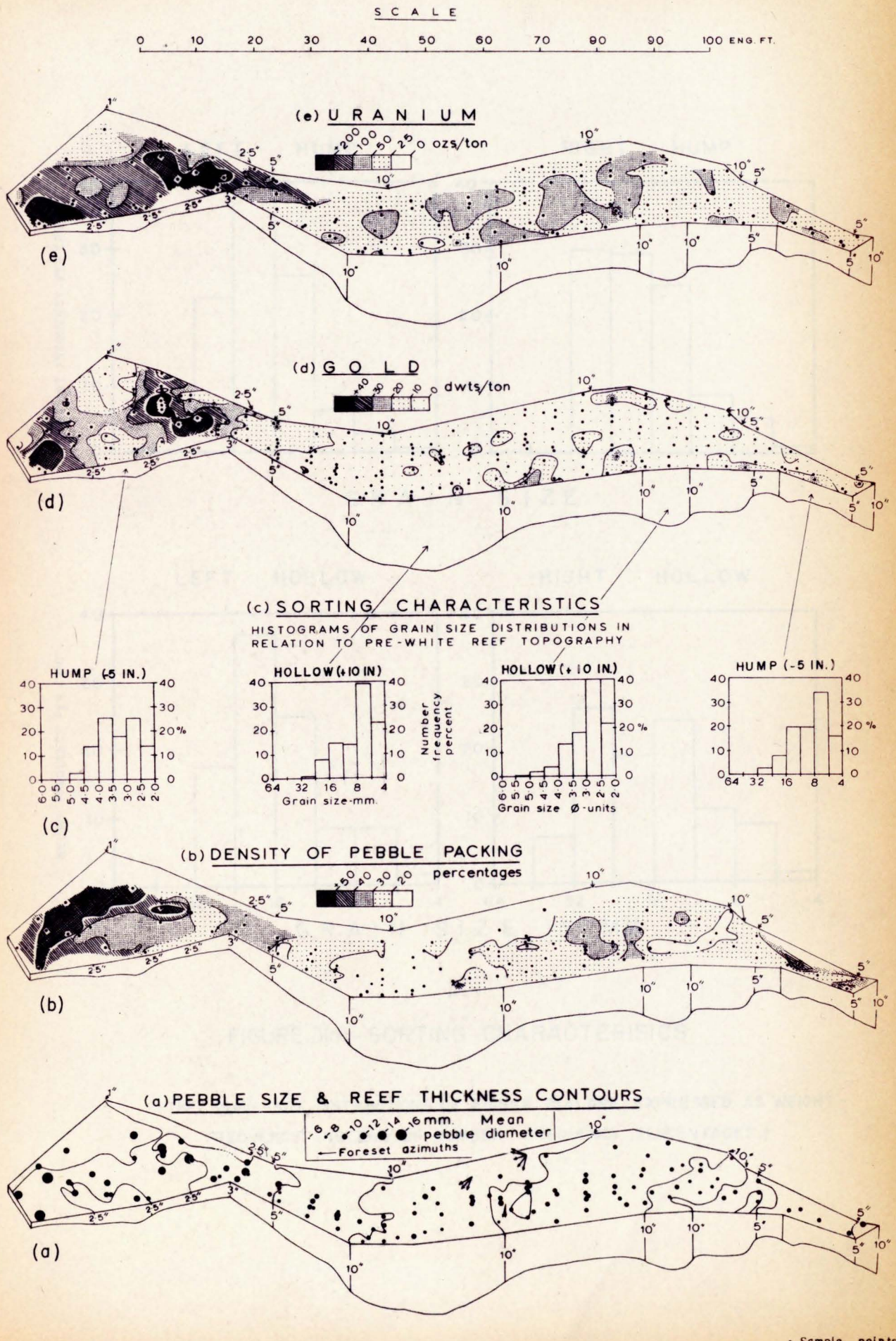
OTHER GOLD MINES.

GEOLOGY

TRANSVAAL SYSTEM
VENTERSDORP SYSTEM
WITWATERSRAND SYSTEM { UPPER DIVISION / LOWER DIVISION
DOMINION REEF SYSTEM
BASEMENT FORMATIONS

L.S.STEYN

FIGURE 2 - BLOCK DIAGRAMS RELATING SOME SEDIMENTOLOGICAL PROPERTIES OF THE CONGLOMERATE TO THE GOLD AND URANIUM CONTENTS, PILOT STUDY AREA.



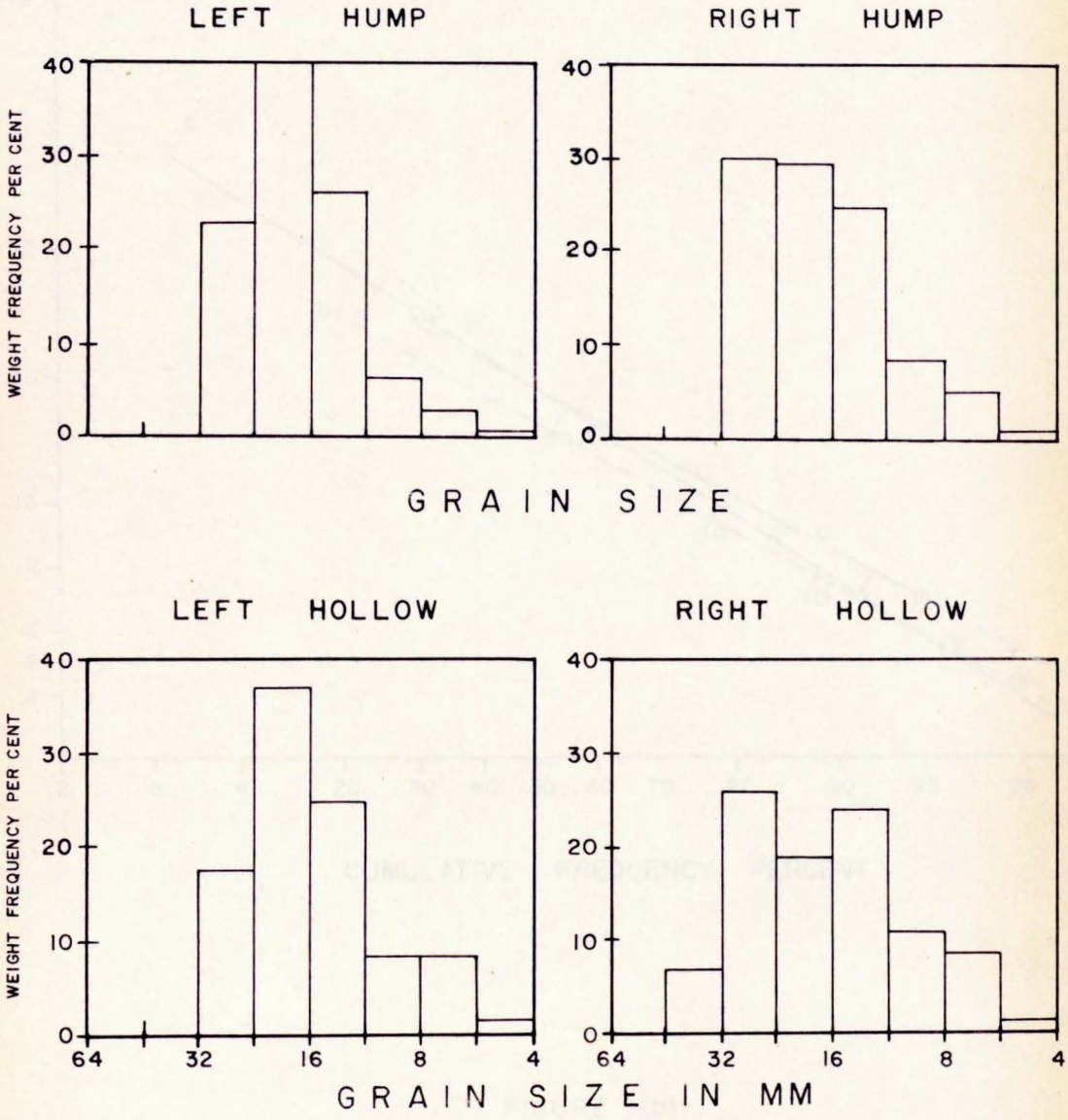


FIGURE 3(a) - SORTING CHARACTERISICS

(THE GRAIN-SIZE DISTRIBUTIONS OF FIGURE 2(c) ARE EXPRESSED AS WEIGHT-FREQUENCY INSTEAD OF NUMBER-FREQUENCY PERCENTAGES.)

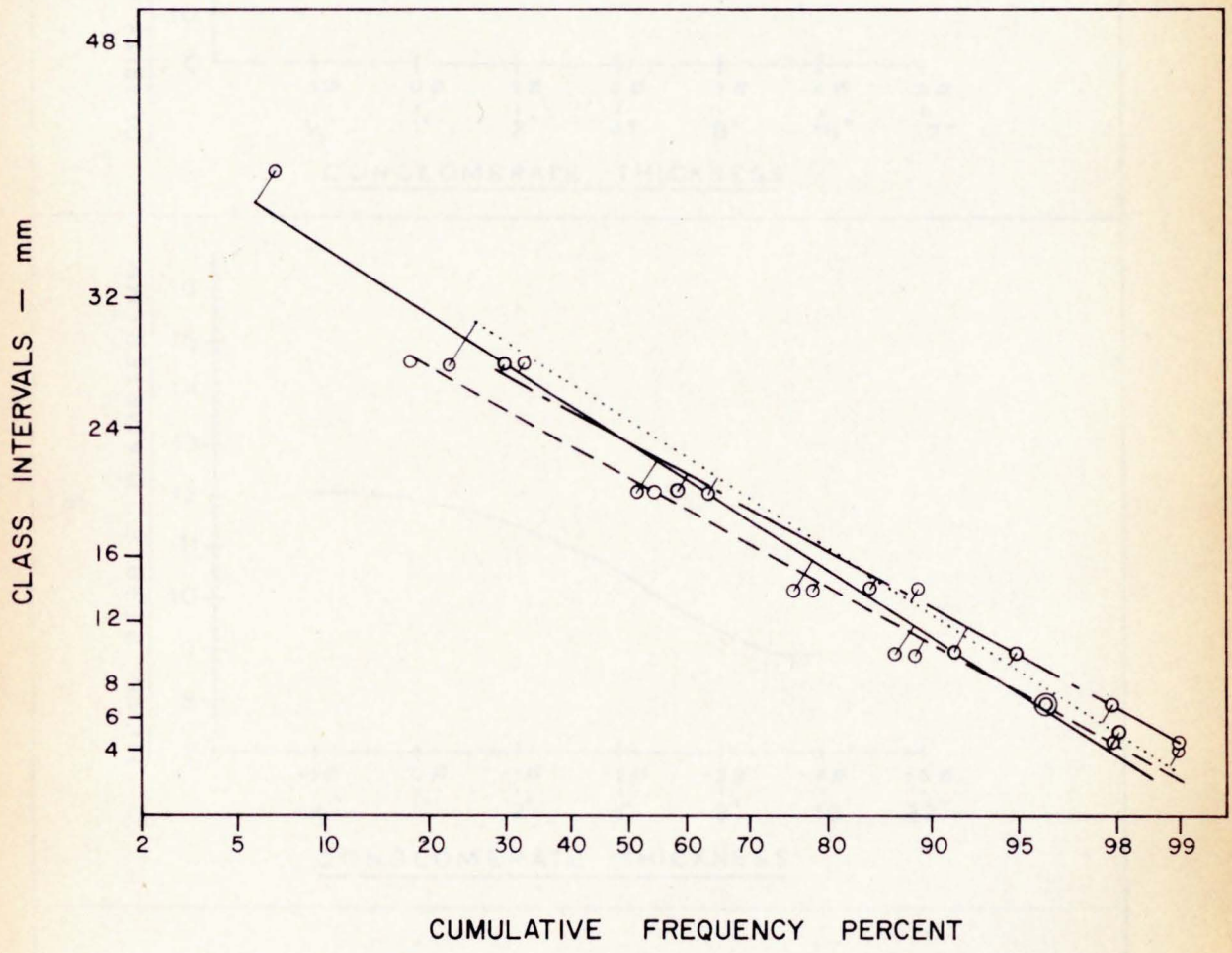


FIGURE 3(b)

GRAIN SIZE DISTRIBUTIONS OF FIGURE 3(a)
PLOTTED ON PROBABILITY PAPER

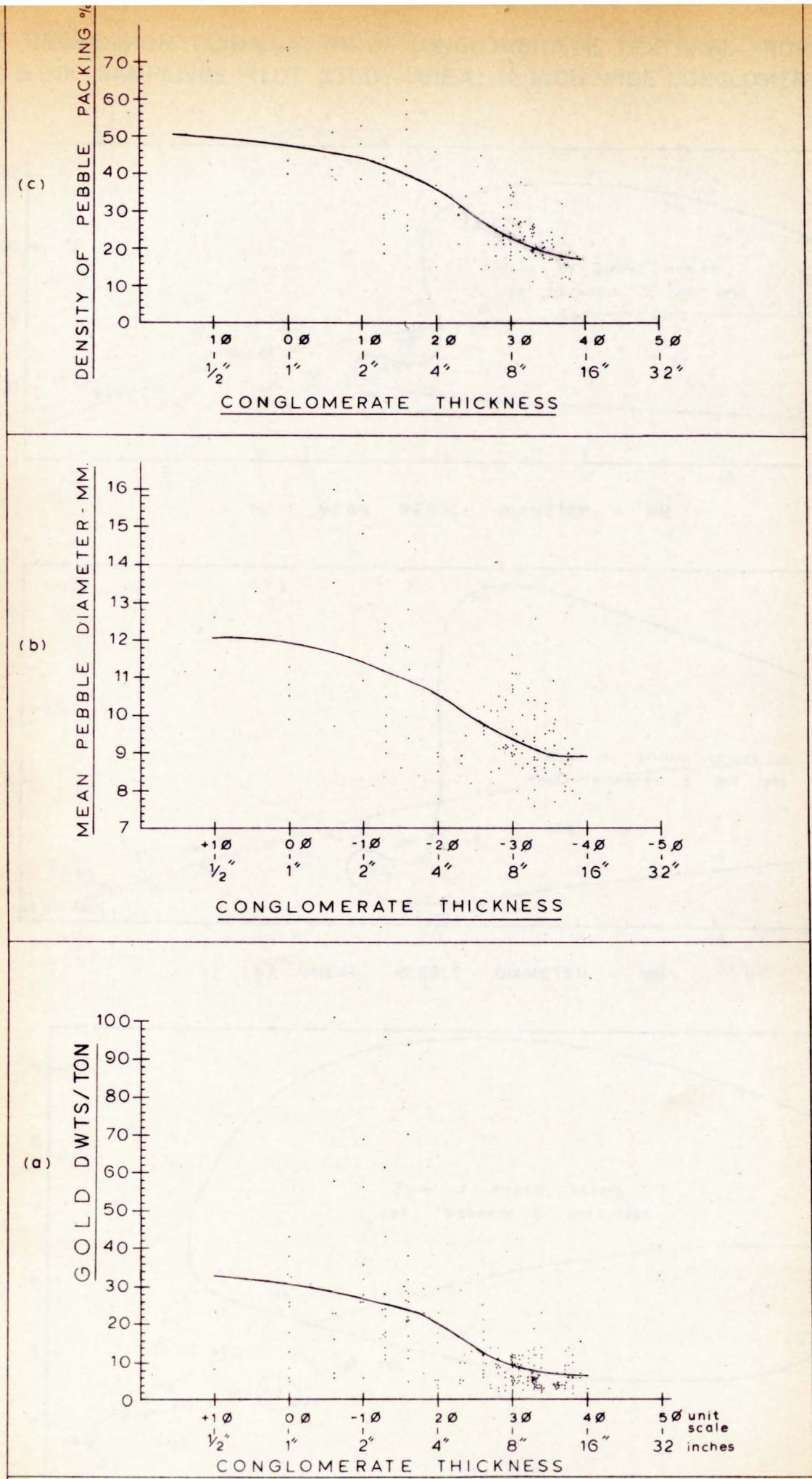
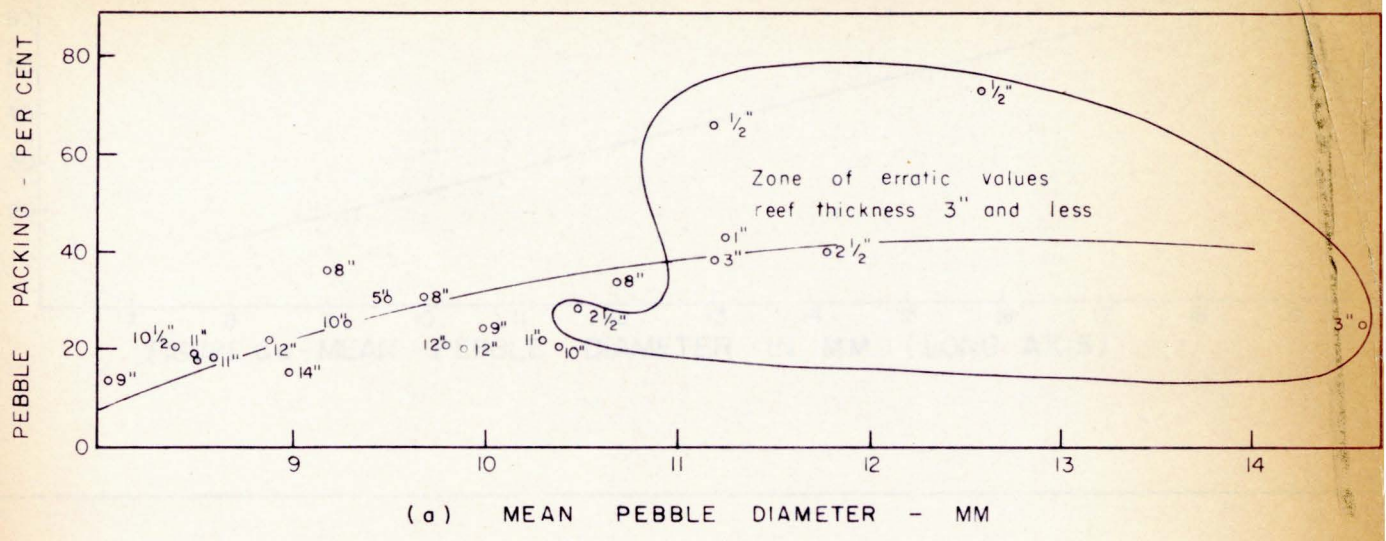
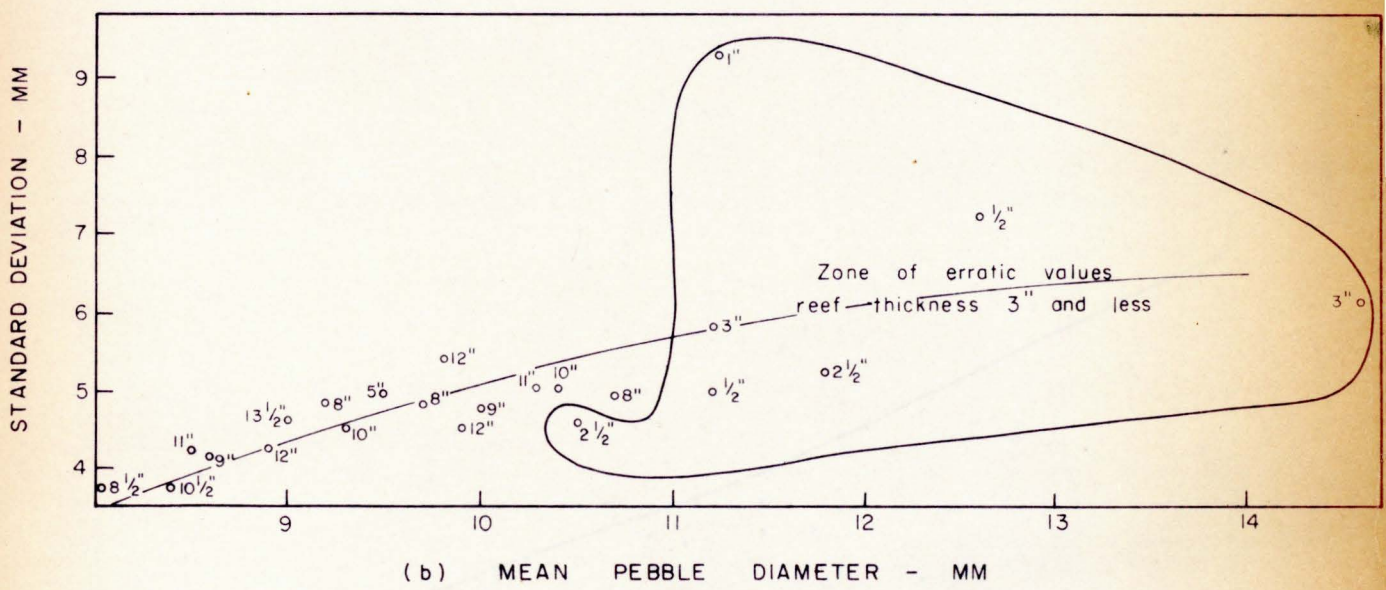
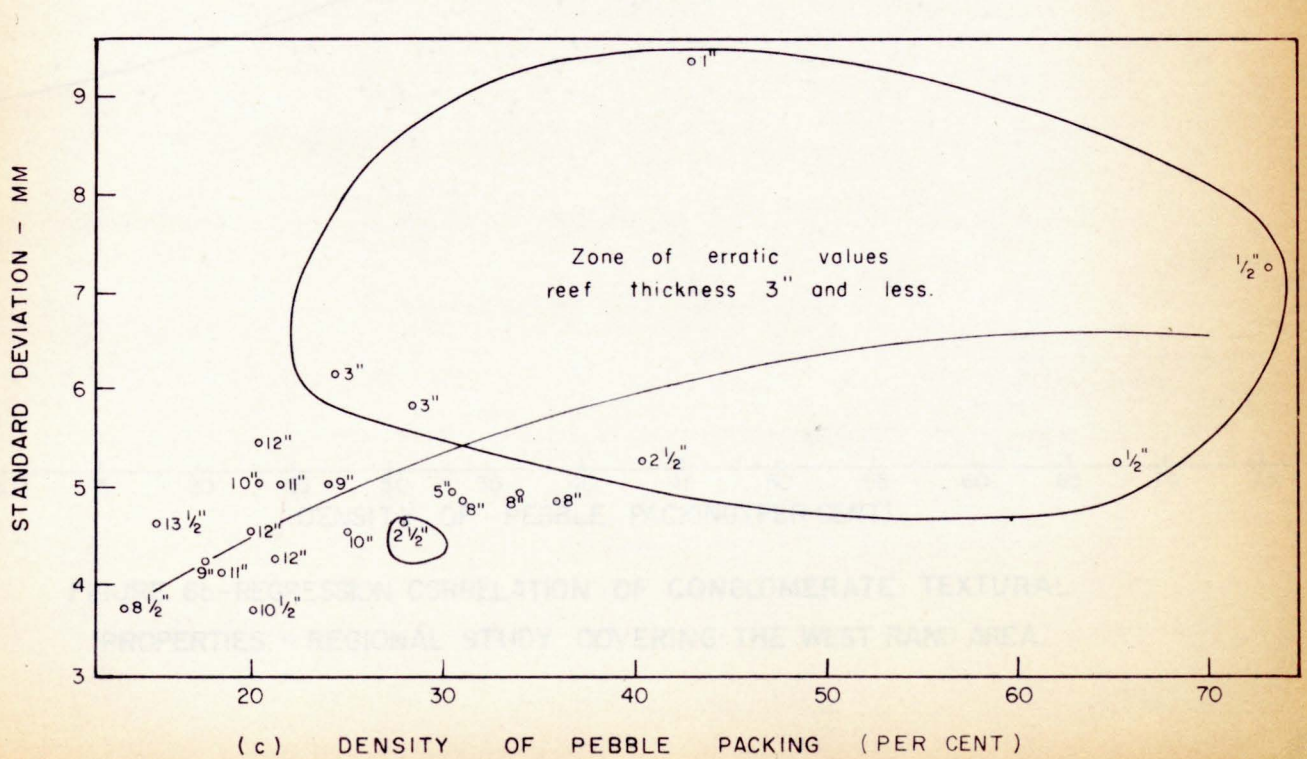


FIGURE 4 REGRESSION CURVES RELATING GOLD CONTENT, MEAN PEBBLE DIAMETER AND PEBBLE PACKING TO CONGLOMERATE THICKNESS.

FIG. 5.- REGRESSION CORRELATION OF CONGLOMERATE TEXTURAL PROPERTIES
7th & 9th SAMPLINGS PILOT STUDY AREA; 12 INCH WIDE CONGLOMERATE STRIPS.







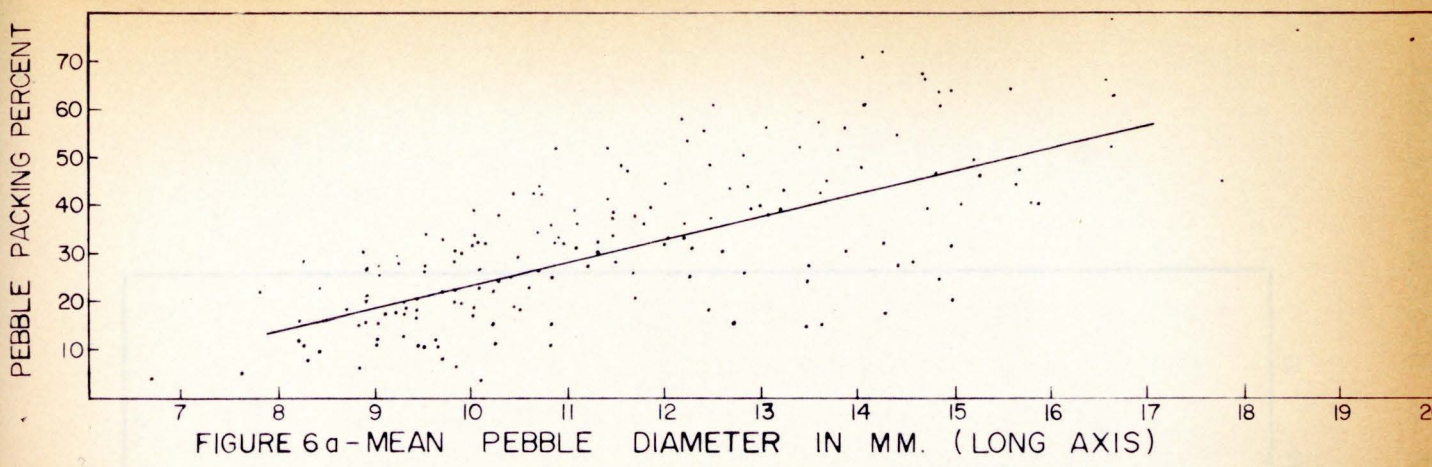


FIGURE 6a - MEAN PEBBLE DIAMETER IN MM. (LONG AXIS)

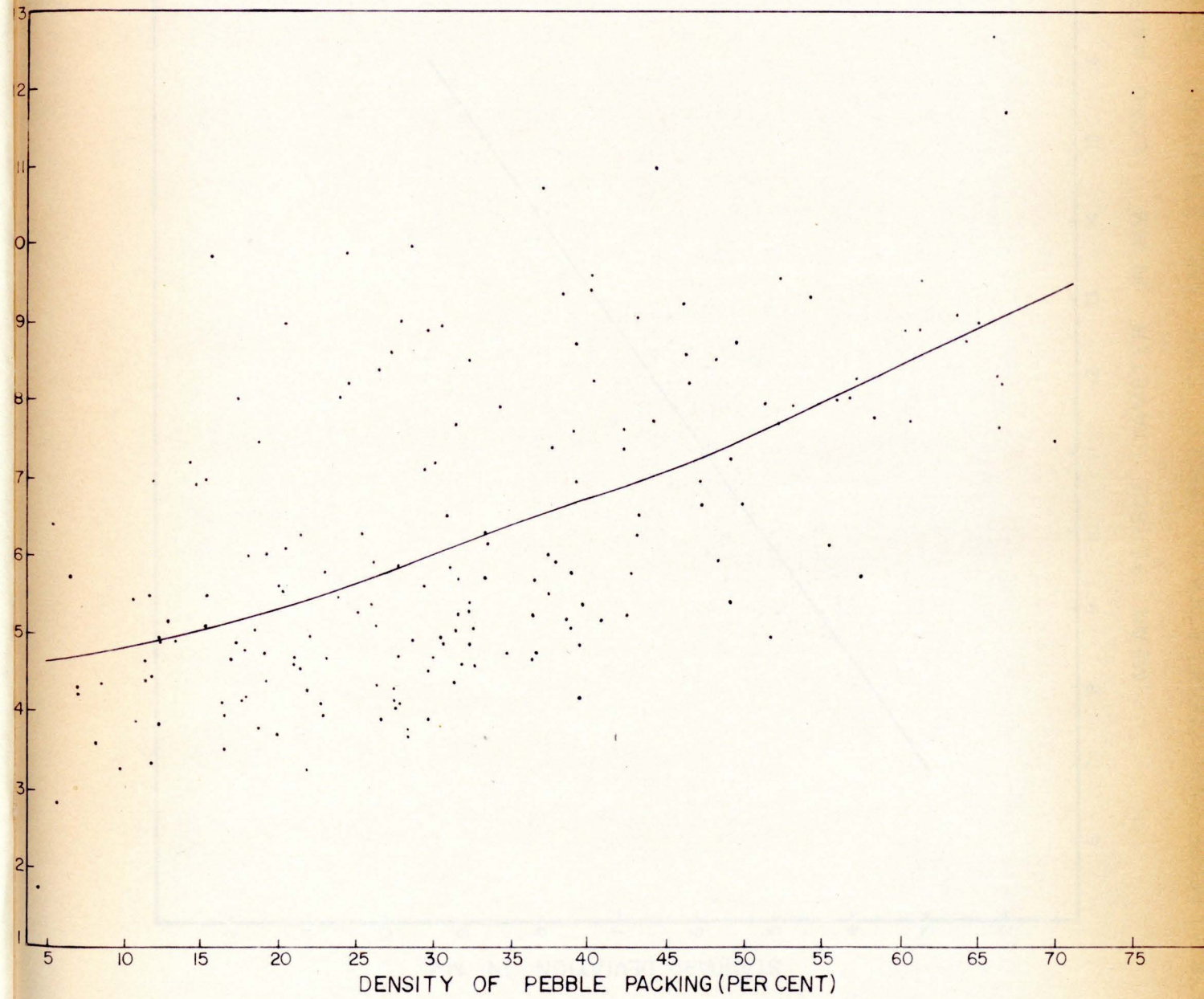


FIGURE 6b - REGRESSION CORRELATION OF CONGLOMERATE TEXTURAL PROPERTIES. - REGIONAL STUDY COVERING THE WEST RAND AREA.

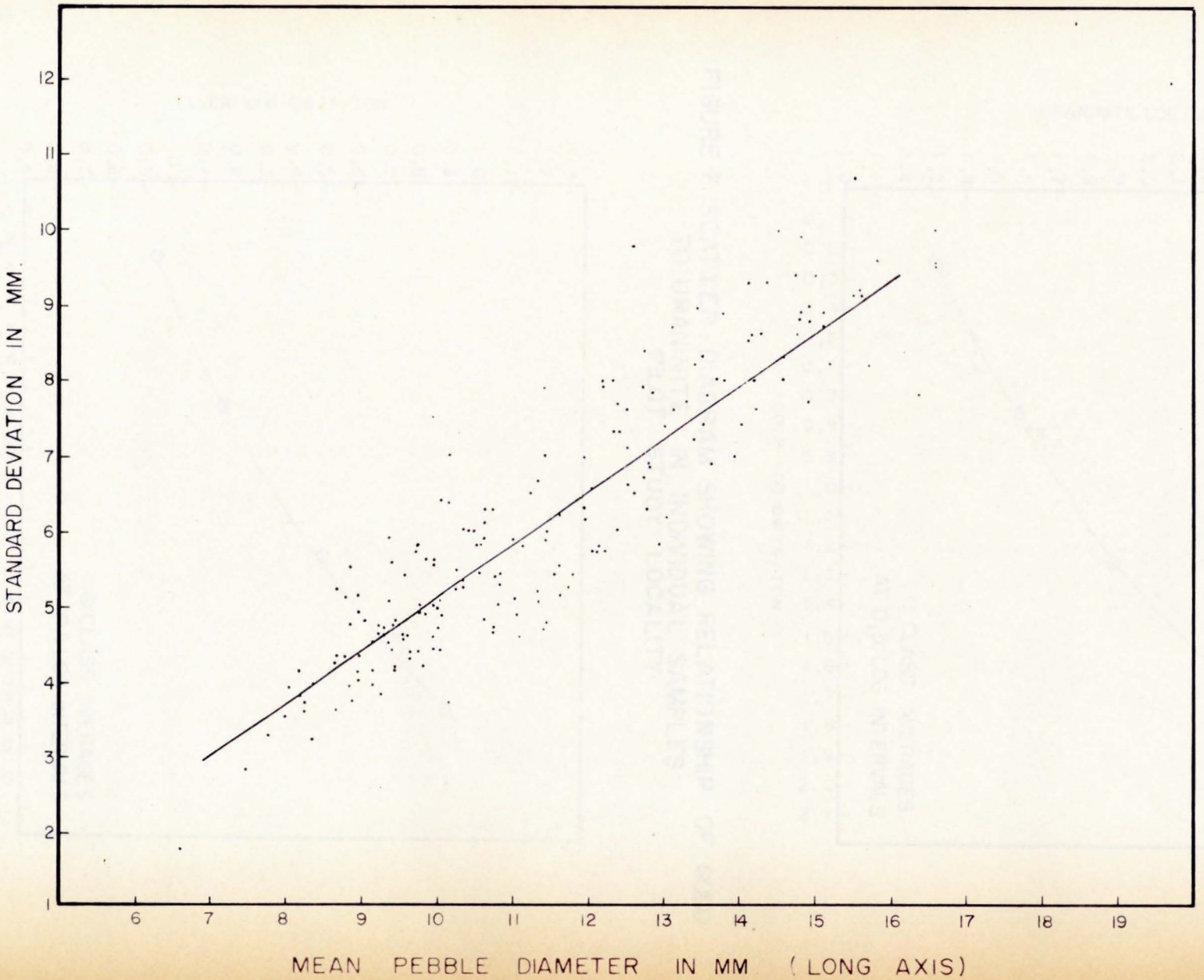


FIGURE 6(c) REGRESSION CORRELATION OF PEBBLE SIZE AND STANDARD DEVIATION — REGIONAL STUDY

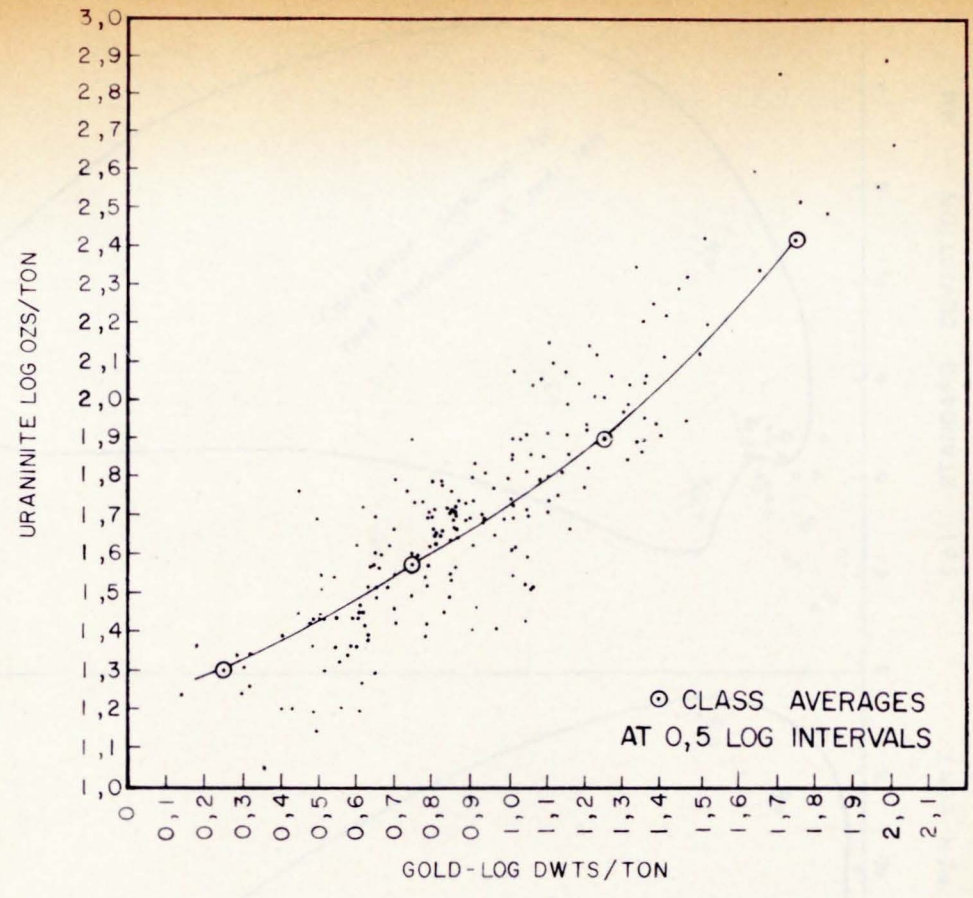


FIGURE 7. SCATTER DIAGRAM SHOWING RELATIONSHIP OF GOLD TO URANINITE IN INDIVIDUAL SAMPLES PILOT STUDY LOCALITY

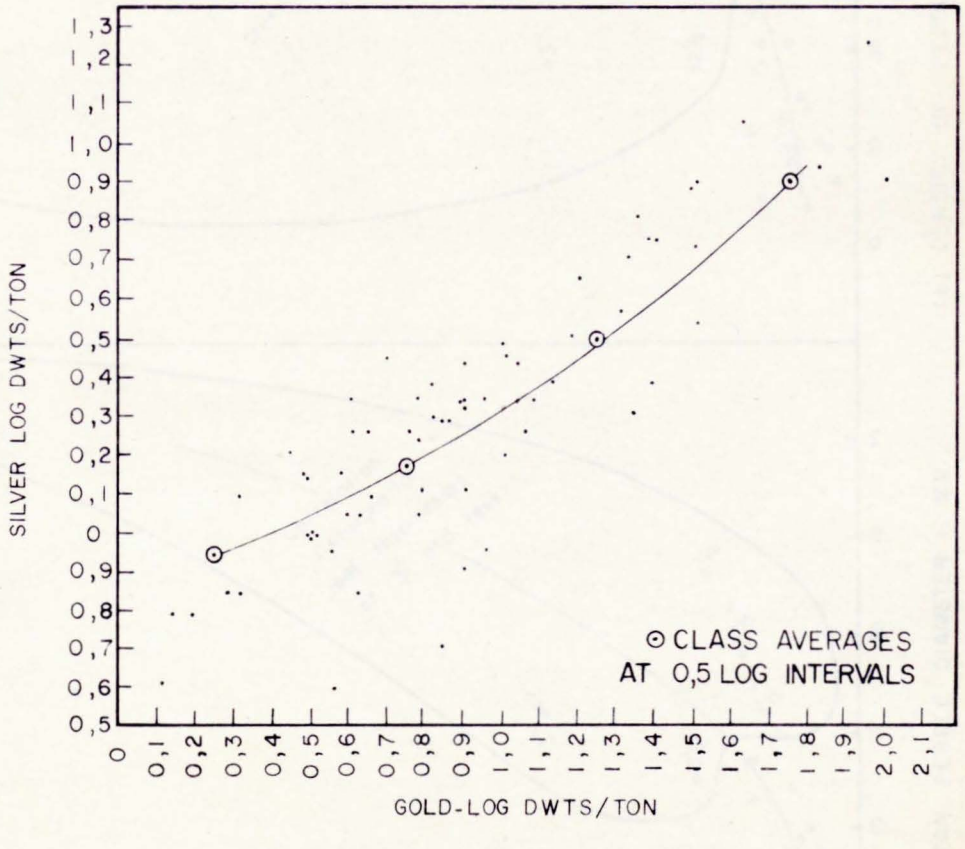
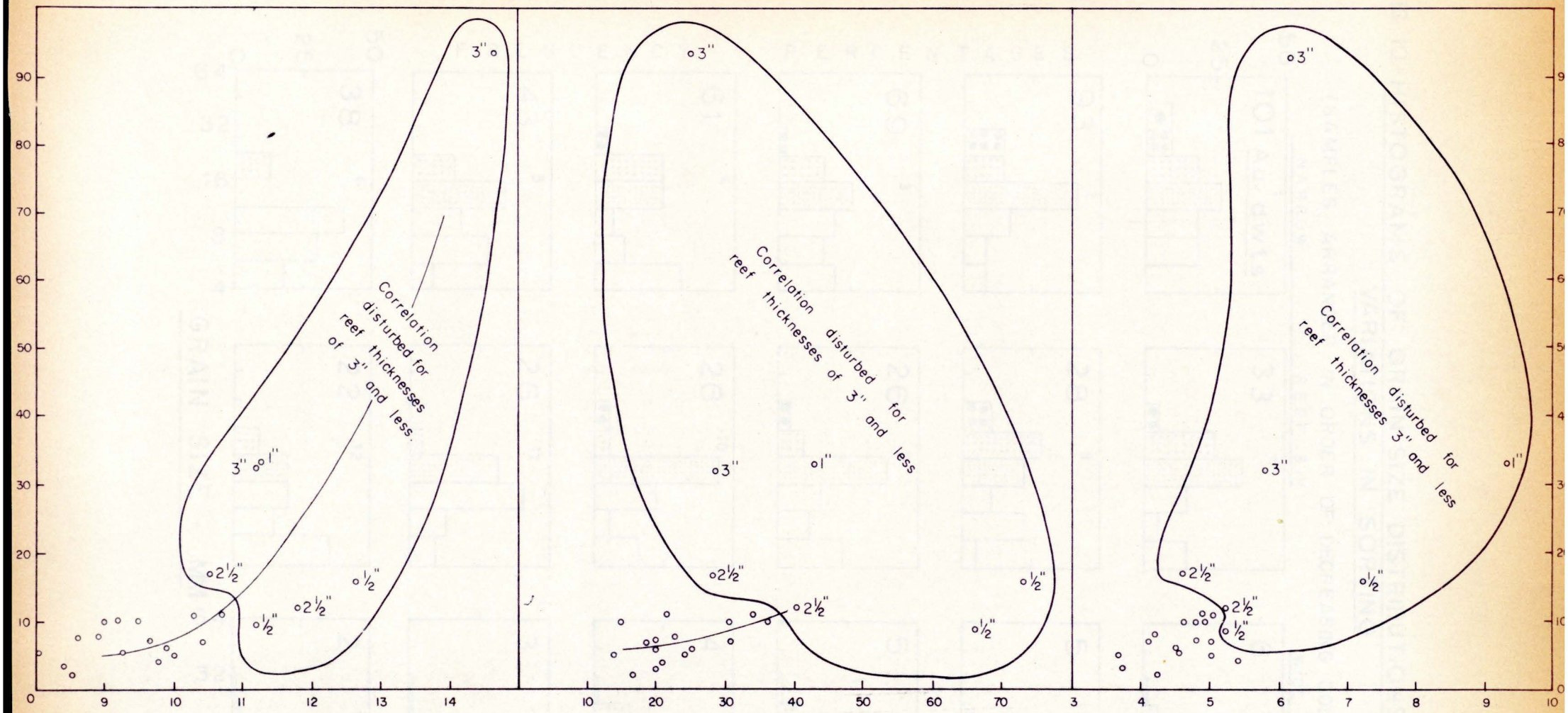


FIGURE 8. SCATTER DIAGRAM SHOWING RELATIONSHIP OF SILVER TO GOLD IN INDIVIDUAL SAMPLES PILOT STUDY LOCALITY



(a) MEAN PEBBLE DIAMETER – MM

(b) DENSITY OF PEBBLE PACKING - PER CENT

(c) STANDARD DEVIATION – MM

FIG. 9 - REGRESSION CORRELATION OF GOLD CONTENT AND CONGLOMERATE TEXTURAL PROPERTIES;
PILOT STUDY 7th AND 9th SAMPLINGS.
(12 INCH WIDE REEF SECTIONS, 10 FEET APART, 3341 GRAINS MEASURED)

FIG. 10.- HISTOGRAMS OF GRAIN SIZE DISTRIBUTIONS SHOWING VARIATIONS IN SORTING

(SAMPLES ARRANGED IN ORDER OF DECREASING GOLD VALUES)

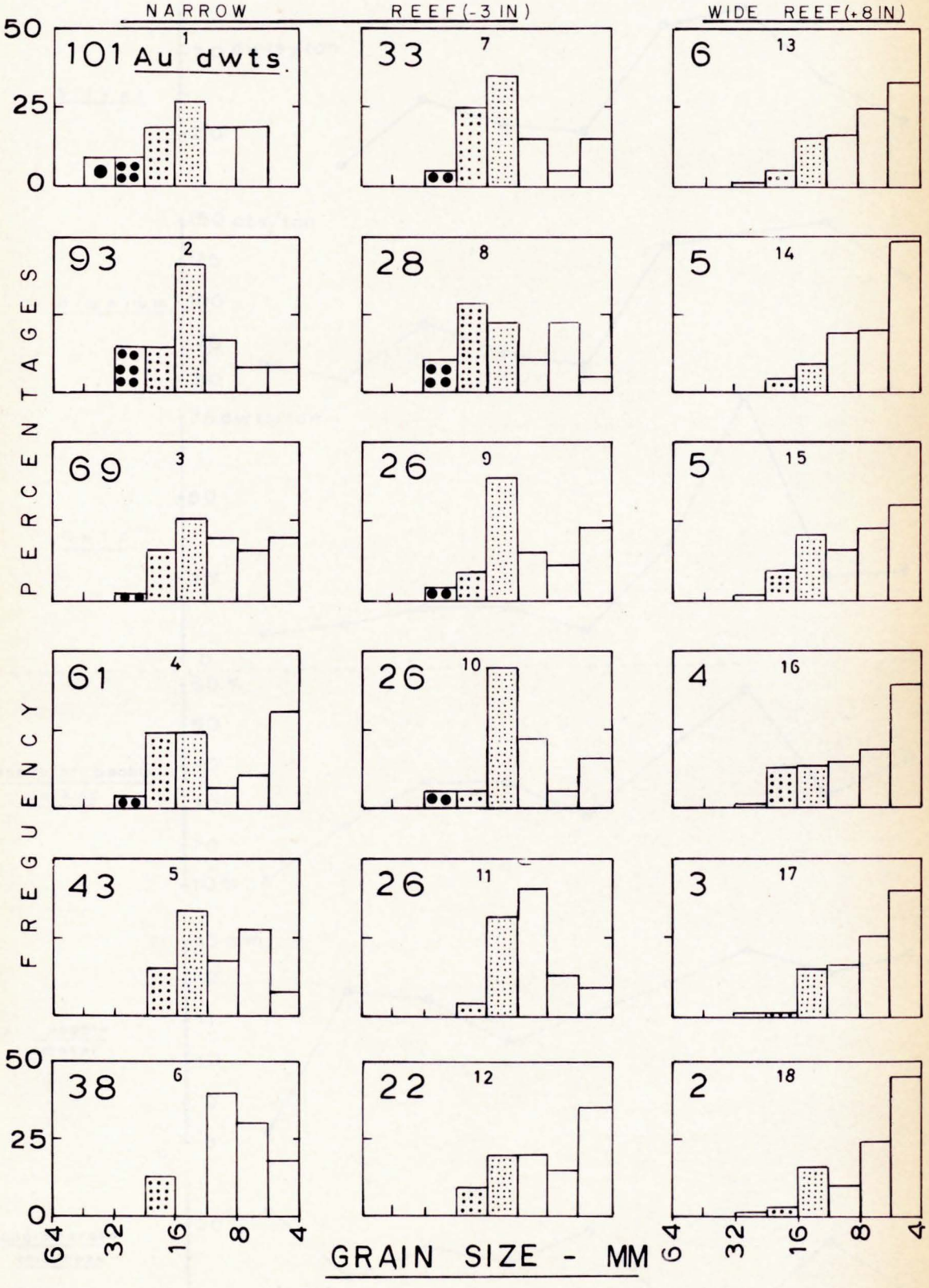
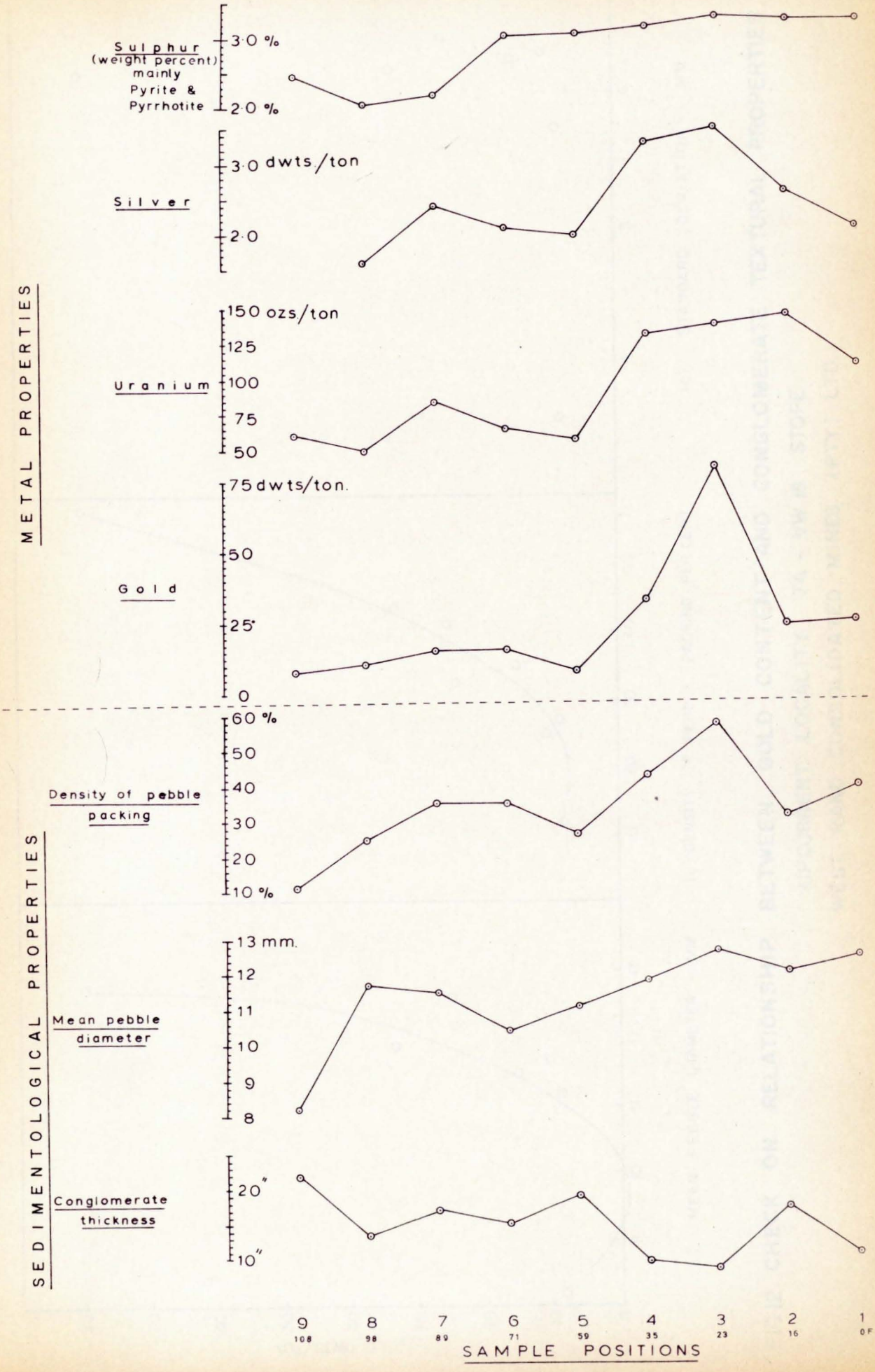


FIG. II.

7[A] VW 18 STOPE - WEST RAND CONSOLIDATED - GRAPHS COMPARING SOME SEDIMENTOLOGICAL PROPERTIES OF THE CONGLOMERATE WITH ORE ANALYSES.



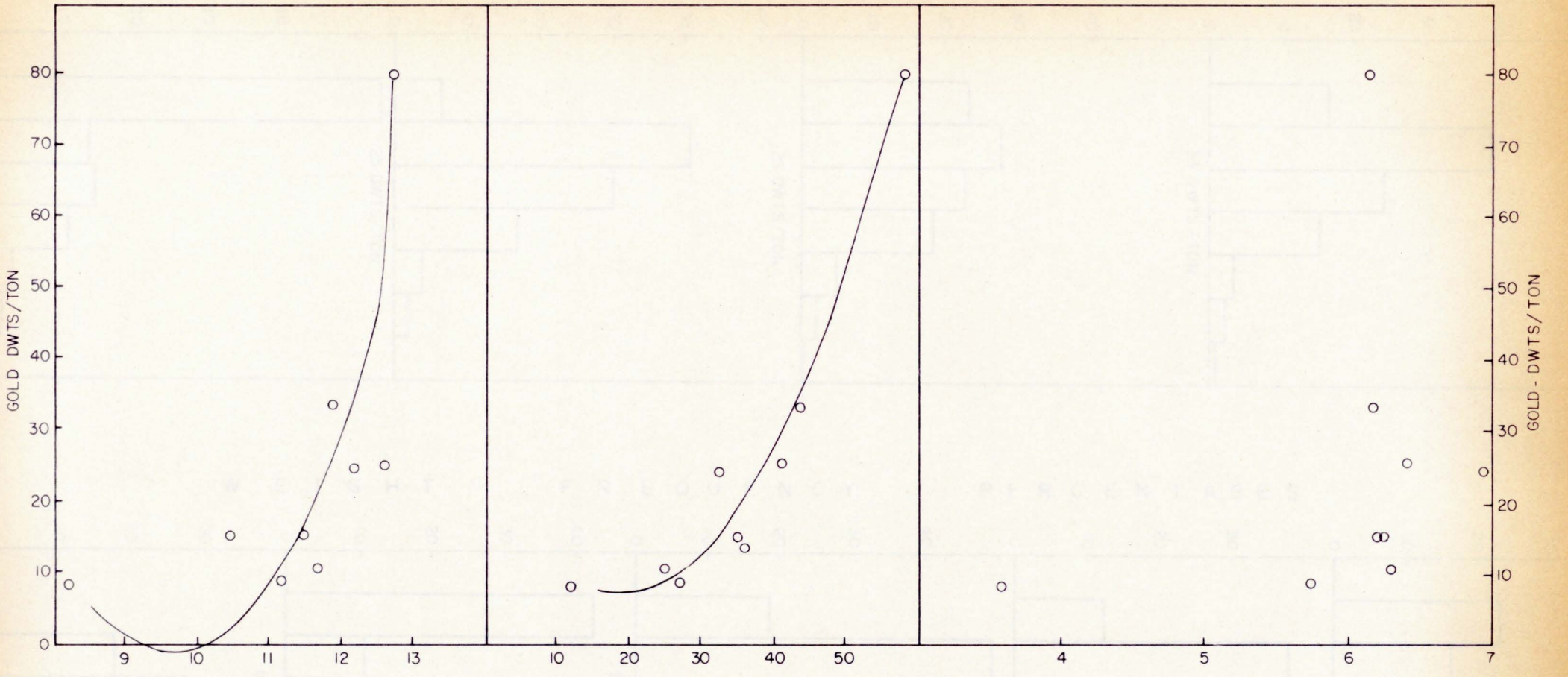


FIG.12. CHECK ON RELATIONSHIP BETWEEN GOLD CONTENT AND CONGLOMERATE TEXTURAL PROPERTIES,
UPCURRENT LOCALITY 7A - VW 18 STOPE
WEST RAND CONSOLIDATED MINES (PTY) LTD.

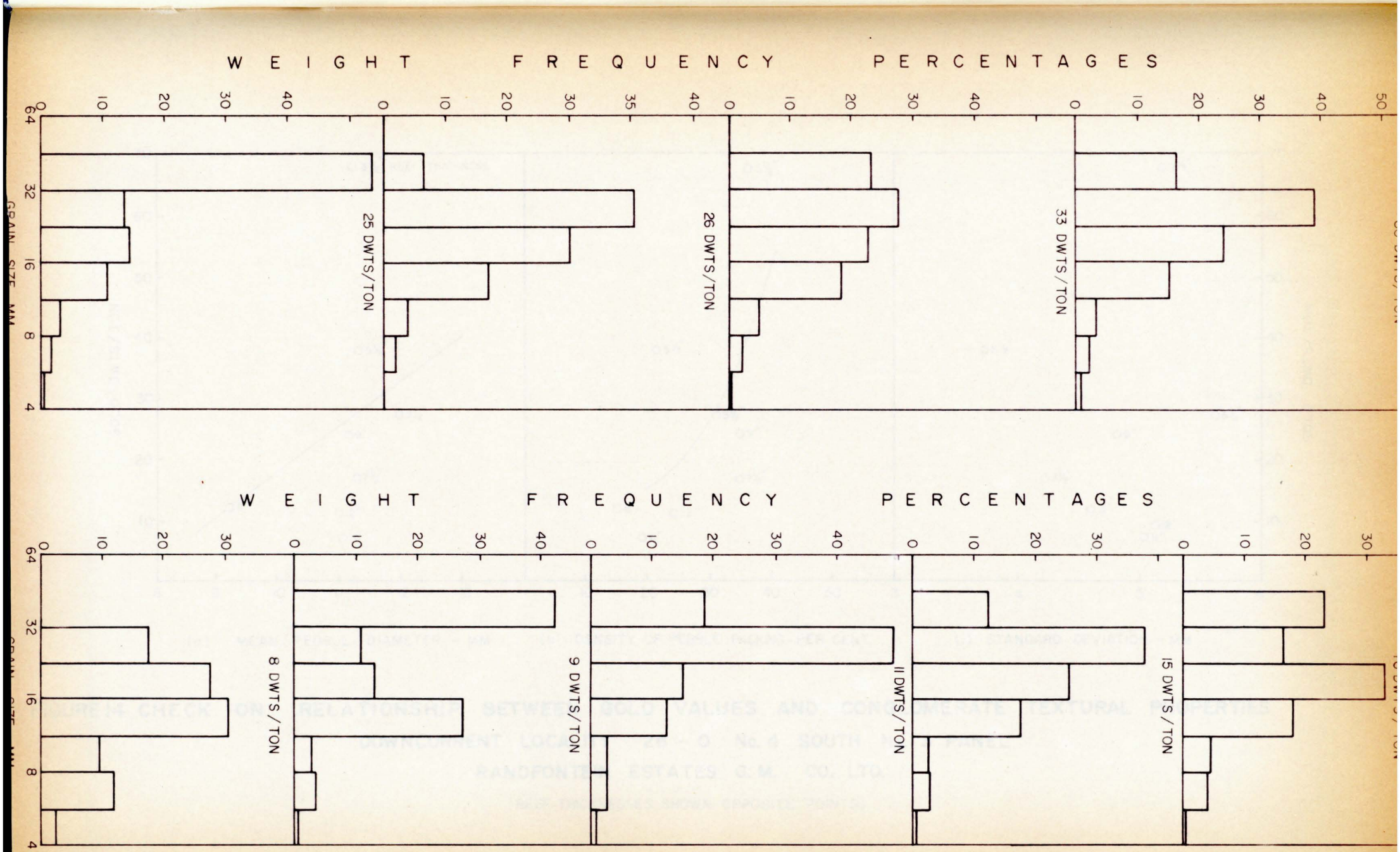


FIGURE 13. HISTOGRAMS OF PEBBLE GRAIN SIZE DISTRIBUTIONS AT DIFFERENT GOLD VALUES 7A - VW18

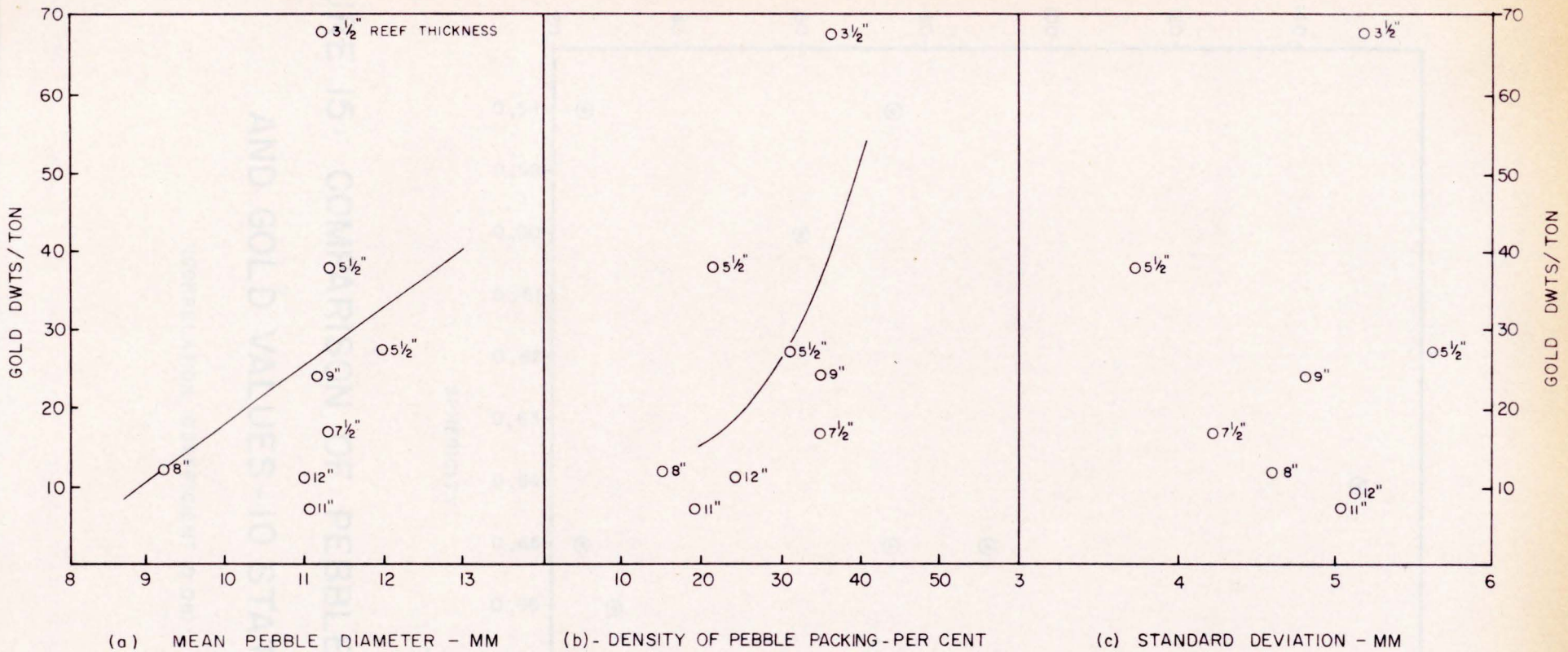


FIGURE 14. CHECK ON RELATIONSHIP BETWEEN GOLD VALUES AND CONGLOMERATE TEXTURAL PROPERTIES

DOWNCURRENT LOCALITY 26 - 0 No. 4 SOUTH No. 3 PANEL

RANDFONTEIN ESTATES G. M. CO. LTD.

(REEF THICKNESSES SHOWN OPPOSITE POINTS)

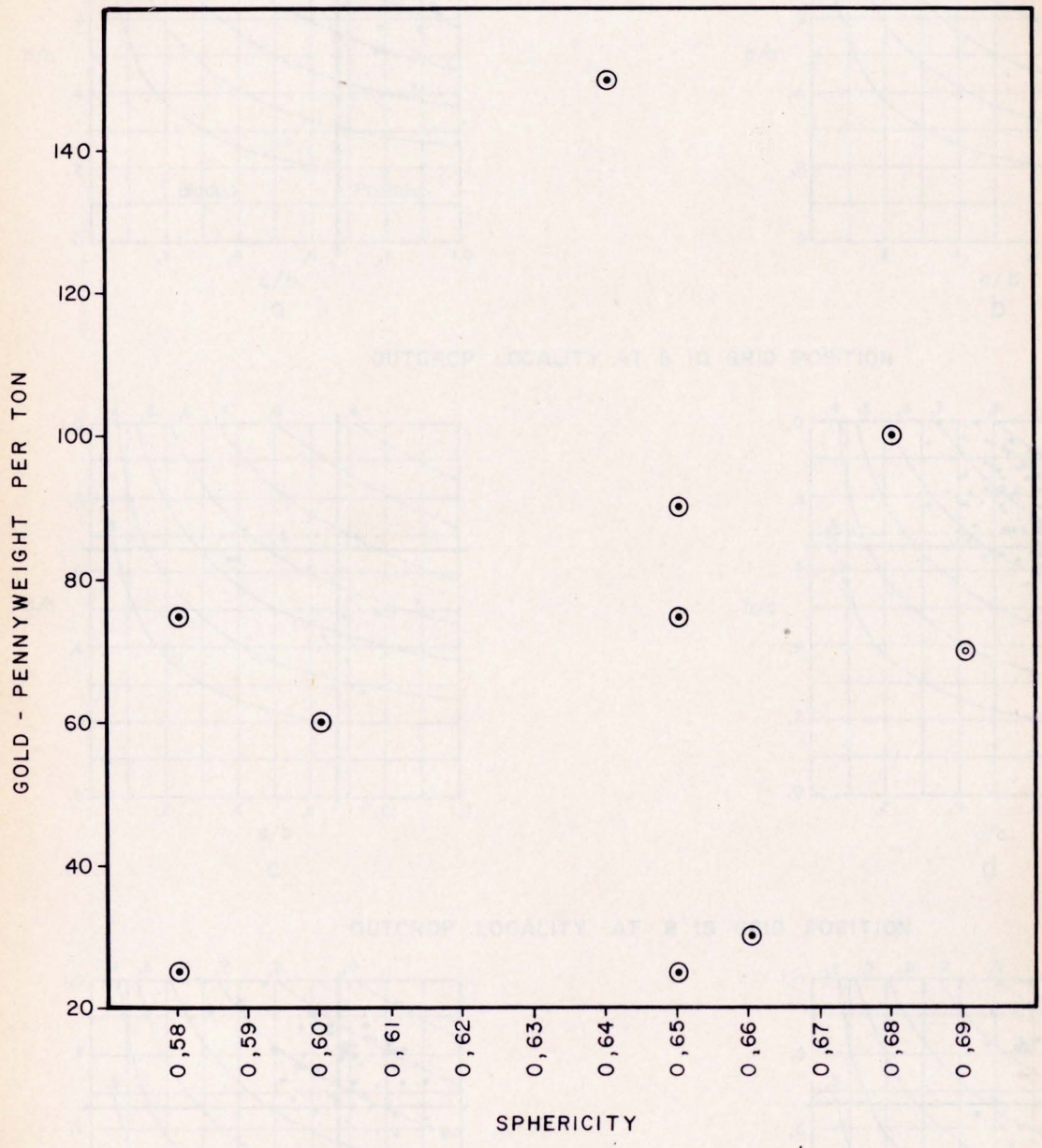


FIGURE 15: COMPARISON OF PEBBLE SPHERICITIES AND GOLD VALUES - 10 STATIONS.

(CORRELATION COEFFICIENT 0·08)

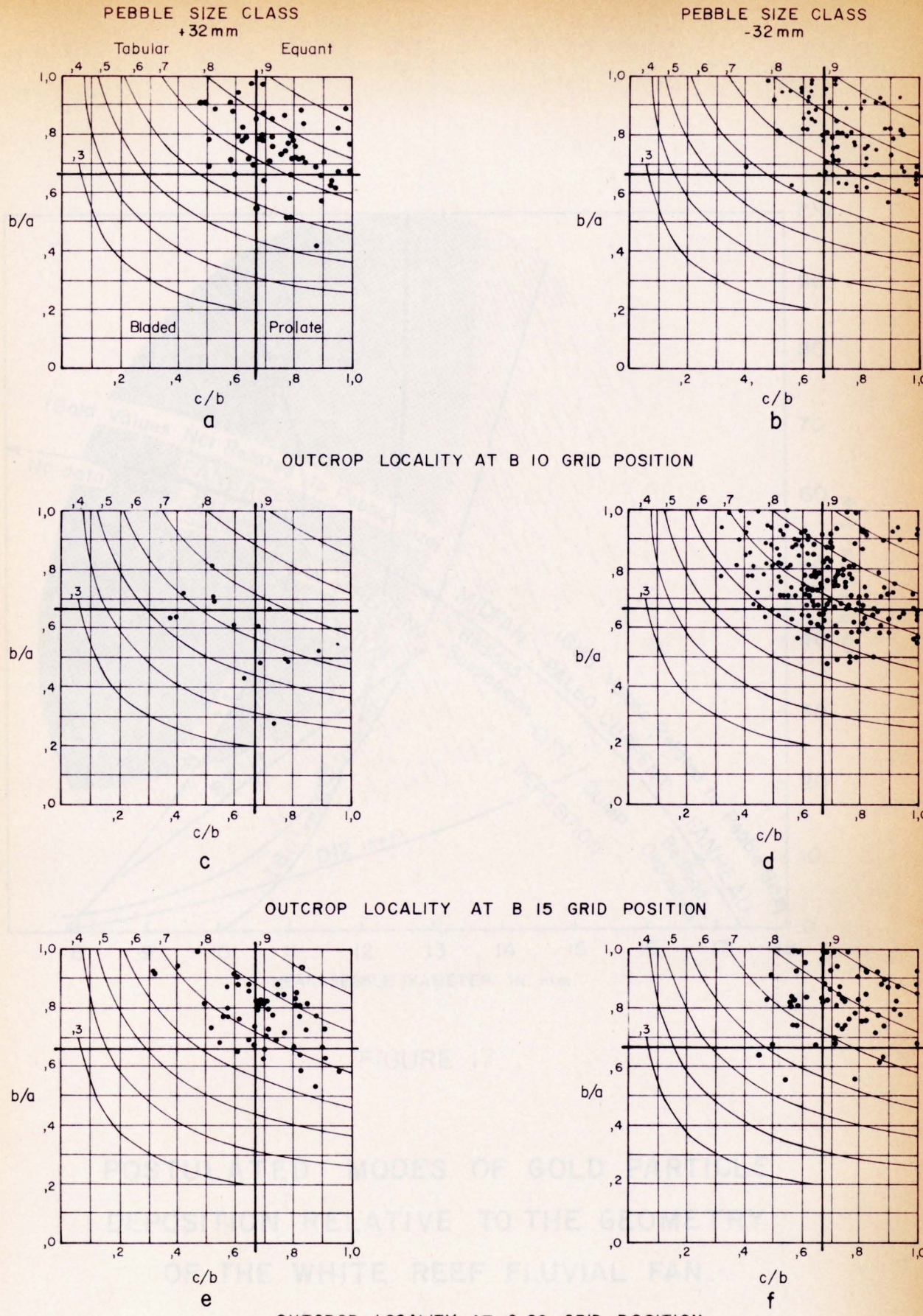


FIGURE 16. PEBBLE SHAPE AND SPHERICITY DISTRIBUTIONS ACCORDING TO ZINGG SHAPE INDICES (PETTIJOHN 1956, p 56)

(THE CURVES REPRESENT LINES OF EQUAL SPHERICITY; KRUMBEIN, 1941)

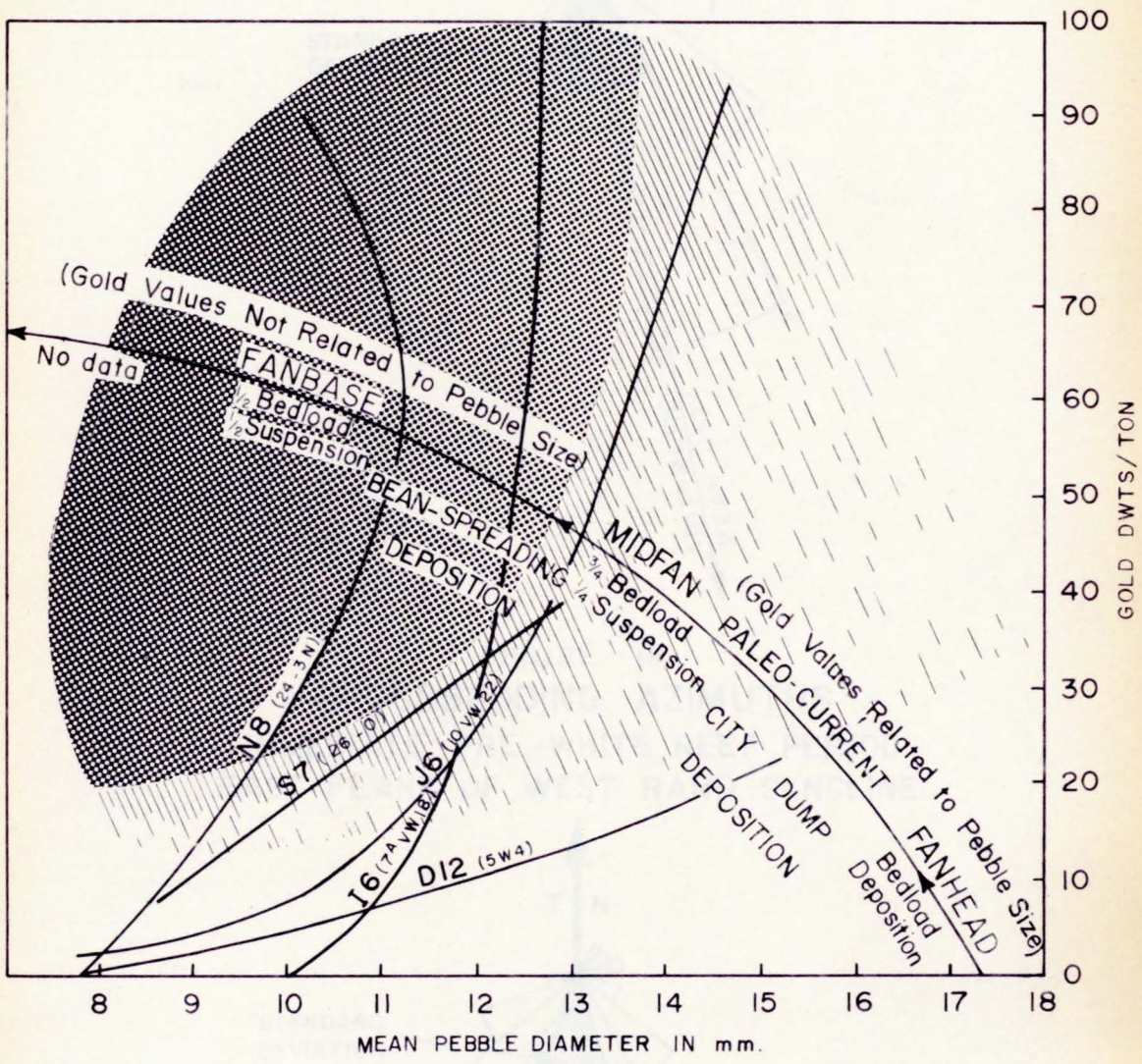


FIGURE 17.

POSTULATED MODES OF GOLD PARTICLE DEPOSITION RELATIVE TO THE GEOMETRY OF THE WHITE REEF FLUVIAL FAN.

(SAMPLING STATIONS, EG. D 12
ON PALEO-CURRENT MAP NO 13)

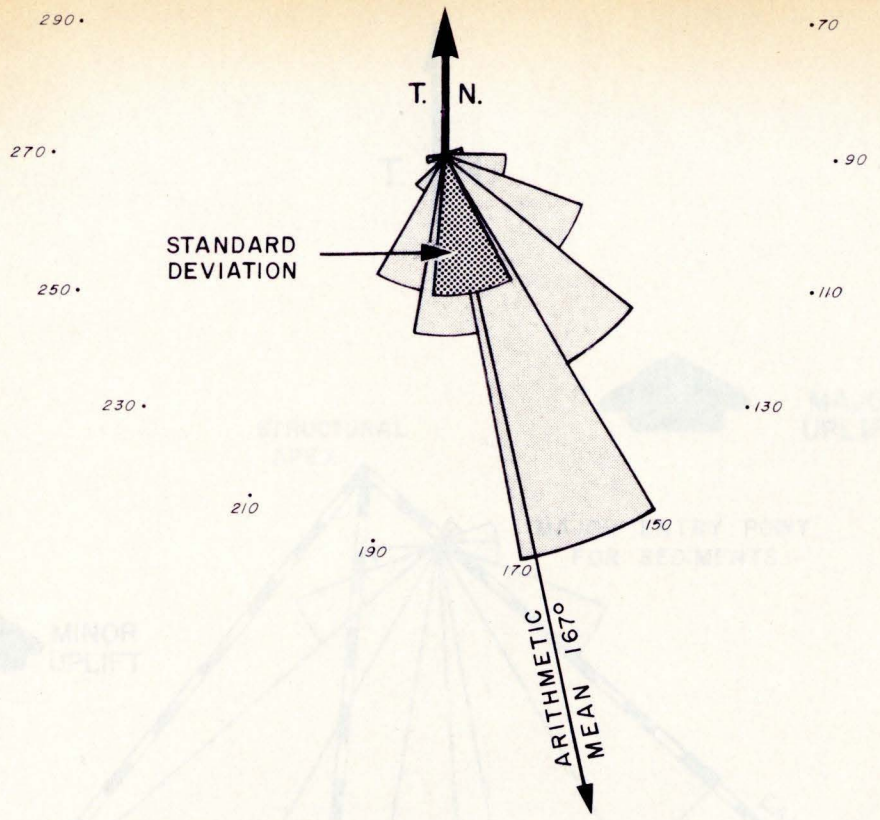


FIGURE 18.

CROSSBEDDING AZIMUTHS

IMMEDIATE PRE-WHITE REEF PERIOD.
EAST FLANK OF WEST RAND SYNCLINE.

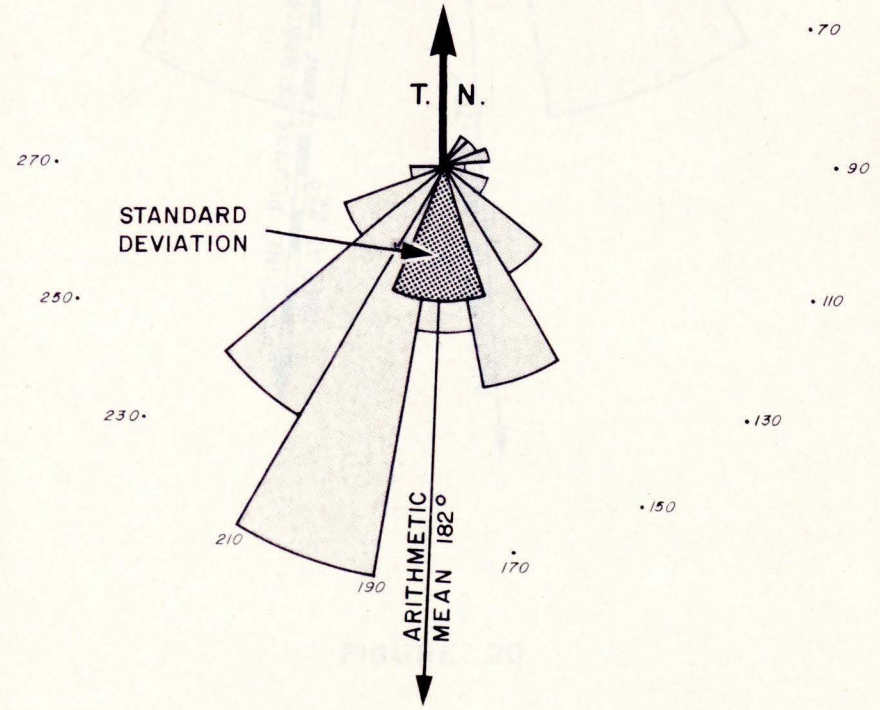


FIGURE 19.

CROSSBEDDING AZIMUTHS

IMMEDIATE PRE-WHITE REEF PERIOD.
WEST FLANK OF WEST RAND SYNCLINE.

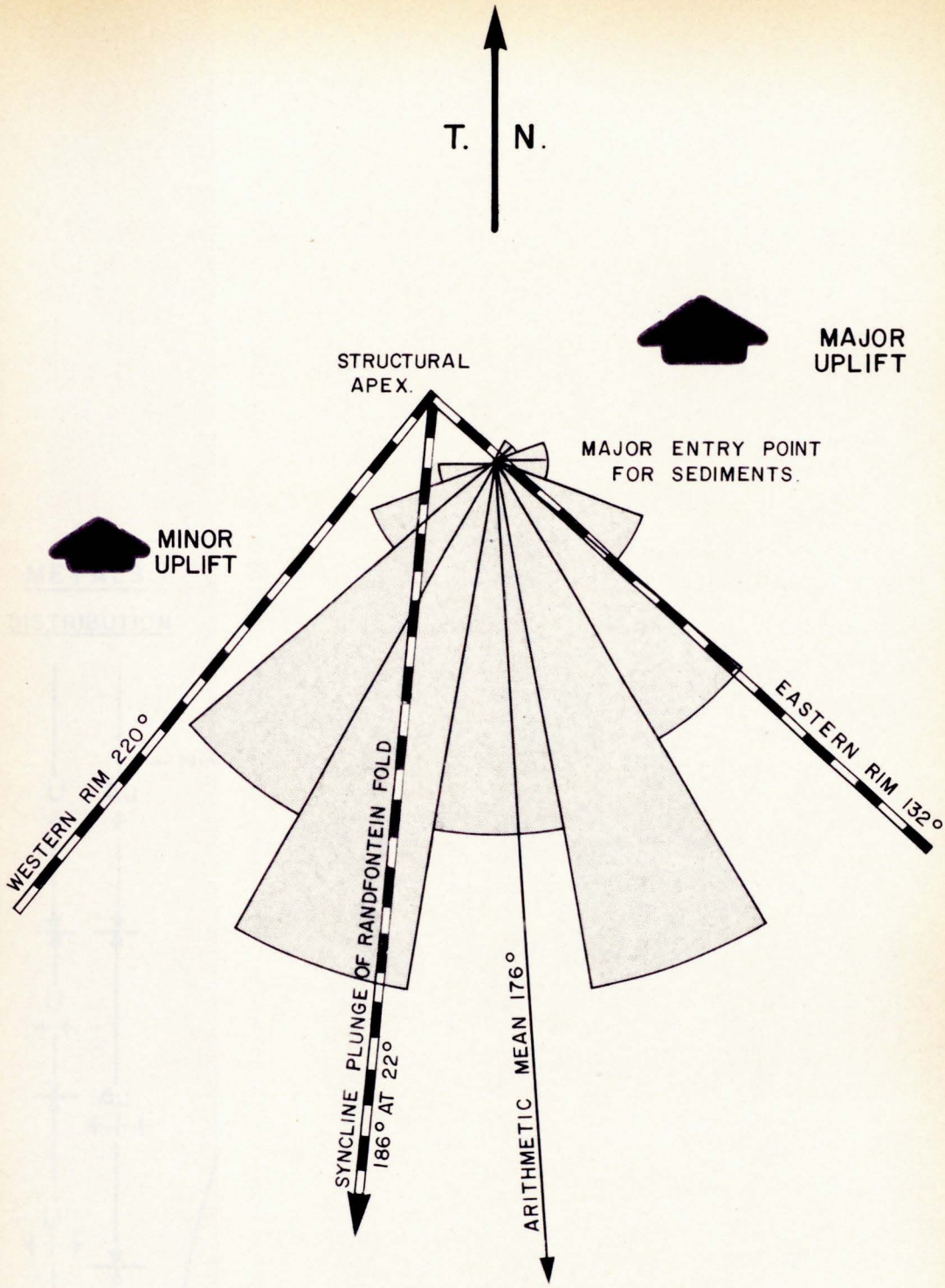


FIGURE 20.

RELATIONSHIP OF PALEOCURRENT AZIMUTHS AND THE STRUCTURE OF THE WEST RAND SYNCLINE FOR THE IMMEDIATE PRE-WHITE REEF PERIOD.

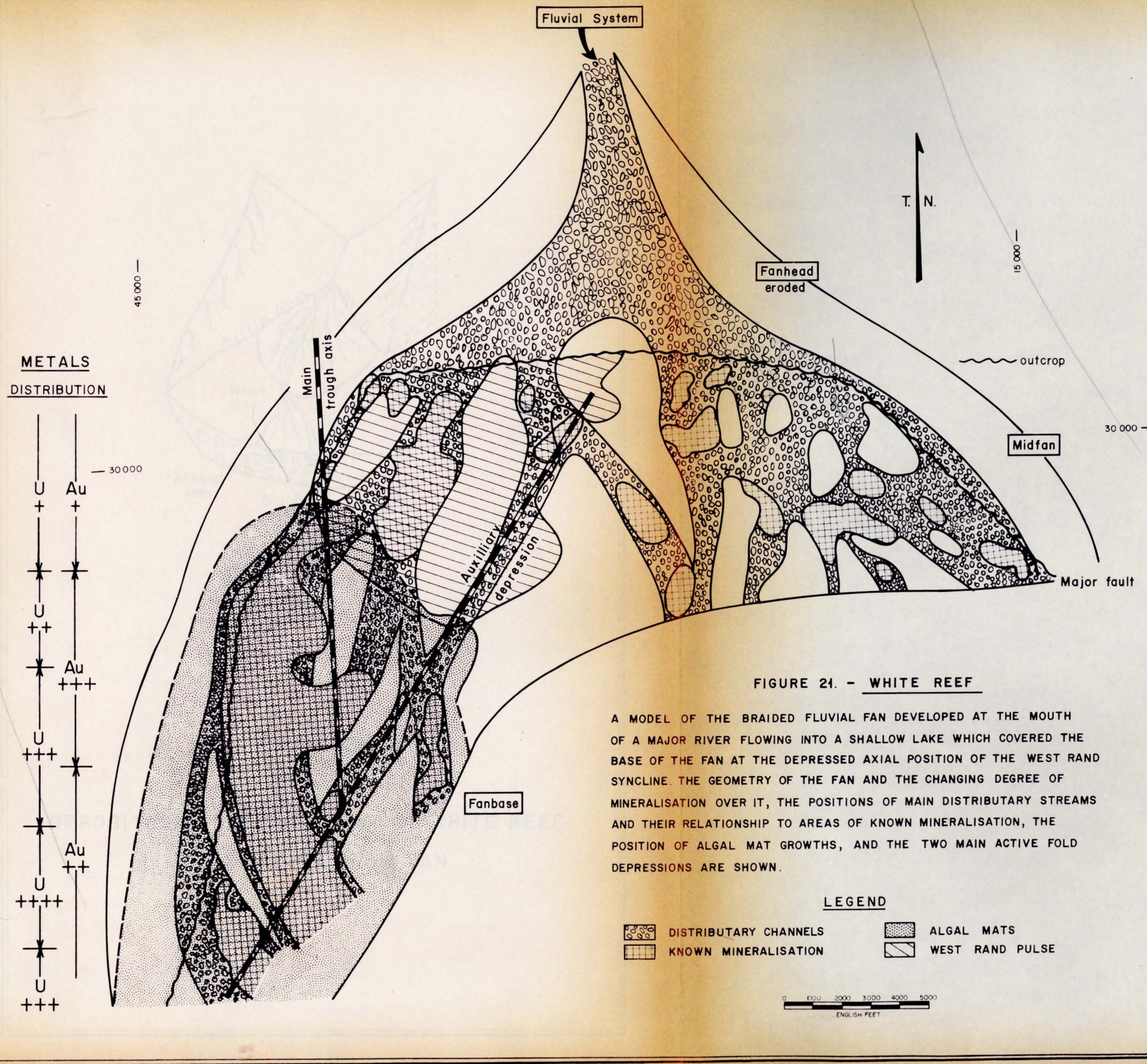


FIGURE 21. - WHITE REEF

A MODEL OF THE BRAIDED FLUVIAL FAN DEVELOPED AT THE MOUTH OF A MAJOR RIVER FLOWING INTO A SHALLOW LAKE WHICH COVERED THE BASE OF THE FAN AT THE DEPRESSED AXIAL POSITION OF THE WEST RAND SYNCLINE. THE GEOMETRY OF THE FAN AND THE CHANGING DEGREE OF MINERALISATION OVER IT, THE POSITIONS OF MAIN DISTRIBUTARY STREAMS AND THEIR RELATIONSHIP TO AREAS OF KNOWN MINERALISATION, THE POSITION OF ALGAL MAT GROWTHS, AND THE TWO MAIN ACTIVE FOLD DEPRESSIONS ARE SHOWN.

LEGEND

- DISTRIBUTARY CHANNELS
- KNOWN MINERALISATION
- ALGAL MATS
- WEST RAND PULSE

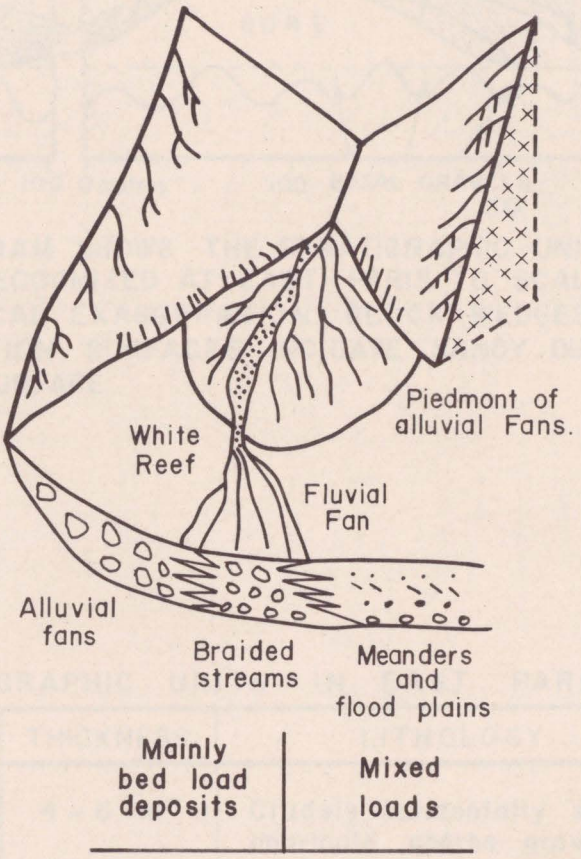
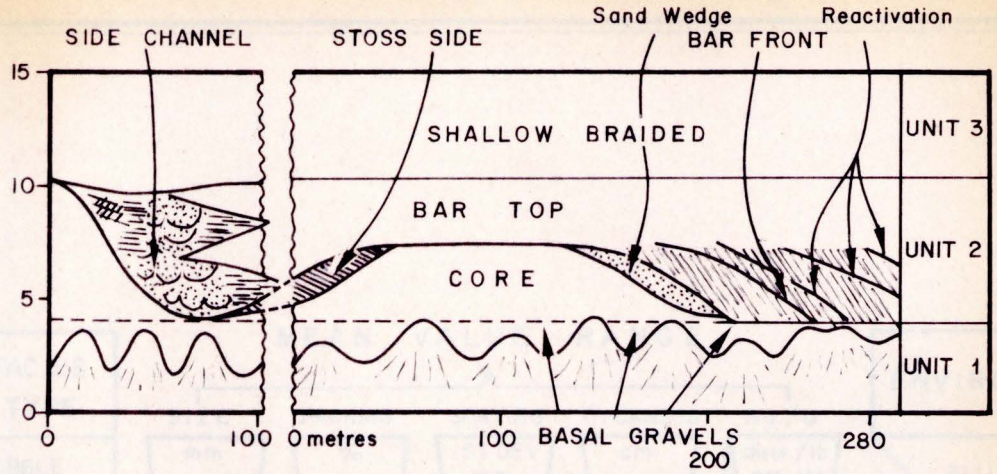


FIGURE 22.

DEPOSITIONAL ENVIRONMENT OF WHITE REEF- A BRAIDED FLUVIAL FAN.



THE DIAGRAM SHOWS THE STRATIGRAPHIC UNITS AND FACIES RECOGNIZED AT EAST PARIS TO SCALE, BUT WITH 4x VERTICAL EXAGGERATION. BLACK WEDGES ON THE REACTIVATION SURFACES INDICATE SANDY DUNES, MOVING UP THE SURFACE.

STRATIGRAPHIC UNITS IN EAST PARIS PIT

UNIT	THICKNESS	LITHOLOGY
3	4 - 6 m*	Crudely horizontally stratified, imbricate coarse gravels with sandy lenses.
2	2 - 6 m	Cross - stratified gravels and sandy gravels, adjacent to wide channel with trough cross - bedded sands.
1†	4 - 9 m	Unstratified to crudely horizontally stratified coarse gravels.

* Minimum thickness - section is lost at top of pit face.

† Rest abrupty on Wentworth Till at south end of pit, but base rarely seen. Thickness is a minimum, 4m for the bulk of the unit, 9m for the areas with topographic highs.

FIGURE 23 : FACIES RELATIONSHIP IN PLEISTOCENE OUTWASH GRAVELS, A MODEL FOR BAR GROWTH IN BRAIDED RIVERS. (After EYNON AND WALKER 1974).

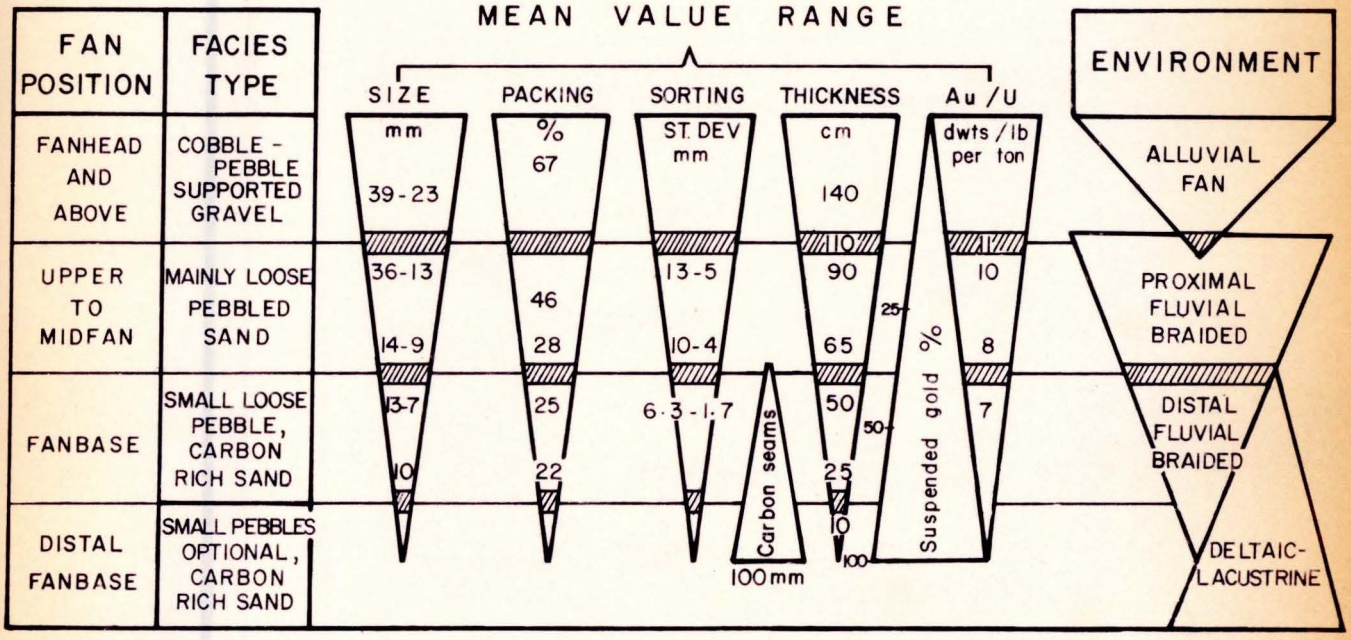
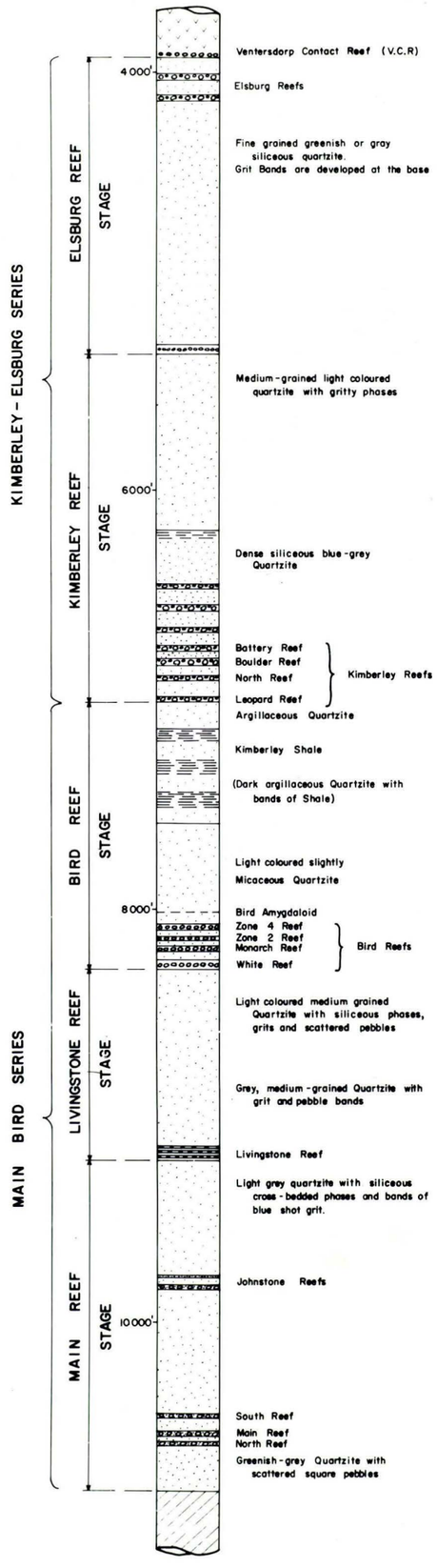


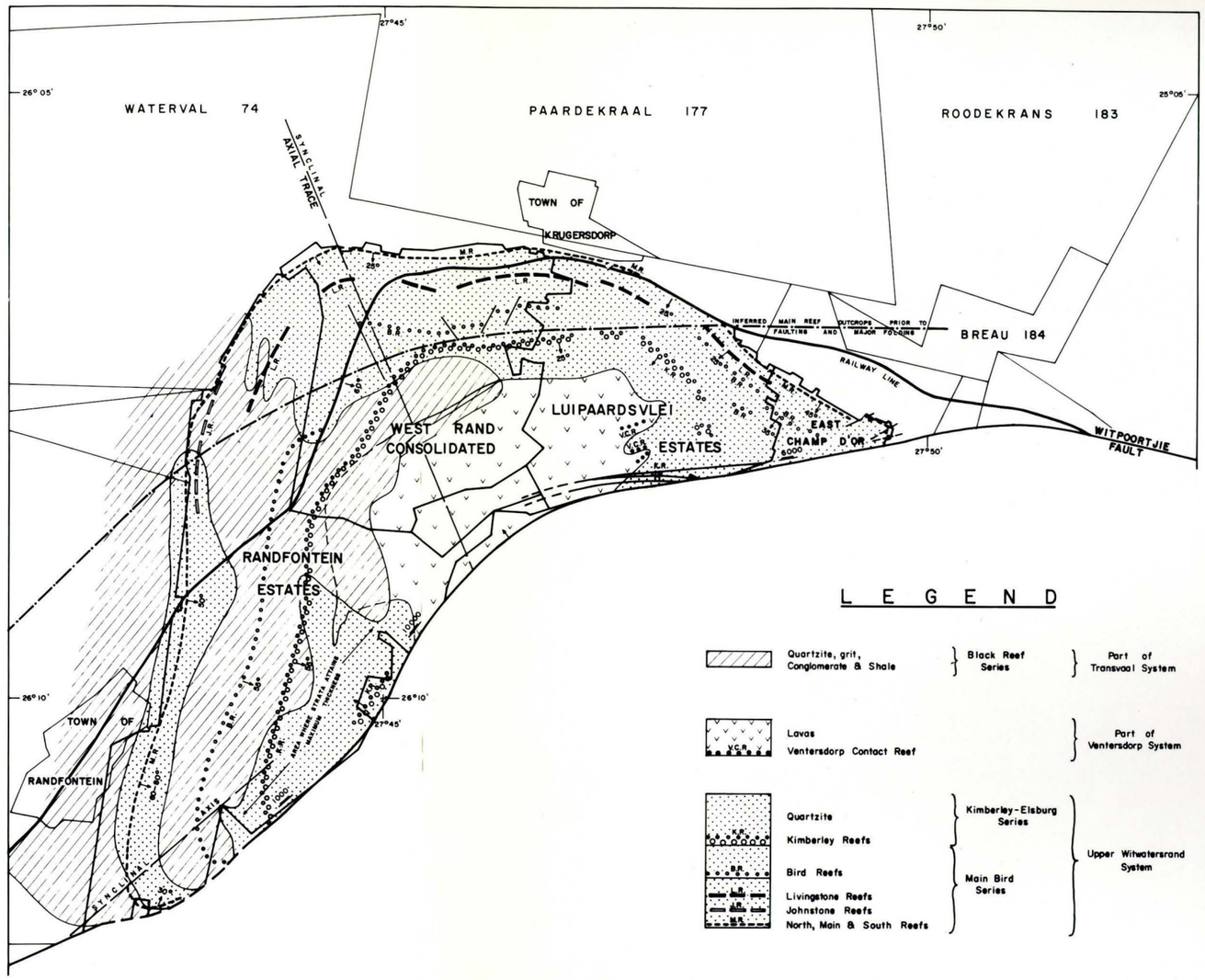
FIGURE 24.

PRELIMINARY PREDICTIVE MODEL FOR THE INDENTIFICATION OF FAN POSITION, FACIES TYPE AND ENVIRONMENT FOR WITWATERSRAND TYPE OF CONGLOMERATES.

GENERALISED GEOLOGICAL SECTION OF THE WEST RAND



GEOLOGICAL MAP OF A PORTION OF THE WEST RAND



L E G E N D

- Quartzite, grit, Conglomerate & Shale — Black Reef Series — Part of Transvaal System
- Lavas, Ventersdorp Contact Reef — Part of Ventersdorp System
- Quartzite
- Kimberley Reefs — Kimberley-Elsburg Series
- Bird Reefs
- Livingstone Reefs
- Johnstone Reefs
- North, Main & South Reefs — Main Bird Series
- Upper Witwatersrand System
- 20° Direction of Dip of Strata with amount in degrees
- Faults on Surface
- Railway Line

0,5 0 1 2 3 4 5 KMS.

0,5 0 1 2 3 MLS.

N

MAP 1.

GEOLOGICALLY SURVEYED IN 1910-1912 BY E.T. MELLOR, DSc. F.G.S.
REVISED USING DATA FROM VARIOUS SOURCES 1962
BY P.D. TOENS DSc. and G.H. GRIFFITHS, BSc, F.G.S. and L.S. STEYN 1963

MAP 2

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT

EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

EAST CHAMP D'OR G.M. CO. LTD.

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

T. N.

outcrop

SUB-OUTCROP

16 SHAFT

SOUTH SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S.V. SHAFT

WEST SHAFT

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

45000 40000 30000 25000 20000 15000

30,000 25,000 20,000 15,

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

THE WHITE REEF ON THE WEST RAND

SCALE

0 1,000 2,000 3,000 4,000 ENGLISH FEET

0 500 1000 1 5000 METRES

EXPOSURES OF THE WHITE REEF CONGLOMERATE

- Surface outcrops
- Underground development on White Reef
- Underground development to reef
- Stoped areas
- Borehole intersections
- Pilot study locality at K_6
- 23 Mine level numbers

L.S. STEYN

MAP 3

THE WHITE REEF ON THE WEST RAND

WEST RAND CONSOLIDATED MINES LTD.

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

EAST CHAMP D'OR G.M. CO. LTD.

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

WEST SHAFT

EAST SHAFT

WEST SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

2N SHAFT

32 SHAFT

S.V. SHAFT

T. N.

outcrop

SUB-OUTCROP

Witpoortje Fault underground

Probable position of the White Reef

SCALE

0 1,000 2,000 3,000 4,000 ENGLISH FEET

0 500 1000 1500 METRES

STRUCTURE CONTOUR MAP

ELEVATION CONTOURS ON WHITE REEF IN ENGLISH FEET — accurate, uncertain, speculative

NORMAL FAULTS — LOSS OF GROUND

REVERSE FAULTS — GAIN OF GROUND

DYKES

ZERO ELEVATION AT 6,000 FT ABOVE SEA LEVEL

Compiled by L.S.STEYN

MAP Nº 4

THE WHITE REEF ON THE WEST RAND

SCALE
0 1000 2000 3000 4000
ENGLISH FEET

RECONSTRUCTED STRUCTURAL CONTOUR MAP AT LEVEL OF WHITE REEF.

ANTICLINAL TRENDS

SYNCLINAL TRENDS

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT

EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

TUDOR SHAFT

CIRCULAR SHAFT

TURK SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S V SHAFT

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

SUB-OUTCROP

Witpoortje Fault underground

Probable position of the WEST RAND SYNCLINE

600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000 3200 3400 3600 3800

Compiled by L S STEYN

MAP Nº 5

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT

EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

WEST RAND SYNCLINE

Fault underground

Outcrop of the

Probable position of the

THE RANDFONTEIN ESTATES G.M. CO. (W.) LTD.

2N SHAFT

32 SHAFT

S V SHAFT

1000

2000

3000

4000

5000

6000

T N

THE WHITE REEF ON THE WEST RAND

SCALE

0 1000 2000 3000 4000

ENGLISH FEET

RECONSTRUCTED STRUCTURAL CONTOUR MAP AT LEVEL OF MAIN REEF.

ANTICLINAL TRENDS

SYNCLINAL TRENDS

Compiled by L S STEYN

MAP Nº 6

THE WHITE REEF ON THE WEST RAND

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT

EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S.V. SHAFT

T.N.

RANDFONTEIN TROUGH

SUB-OUTCROP

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

WITPOORTJIE TROUGH

Witpoortjie fault underground

Probable position of Witpoortjie fault

SCALE

0 1000 2000 3000 4000

ENGLISH FEET

ISOPACH CONTOURS : SOUTH-MAIN REEF (AFTER TOENS AND GRIFFITHS-1964)
(UNITS IN FEET)

AXIS OF MAXIMUM THICKENING

Map 7

WEST RAND CONSOLIDATED MINES LTD.

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

EAST CHAMP D'OR G.M. CO. LTD.

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

WEST SHAFT

EAST SHAFT

WEST SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

SV SHAFT

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

outcrop

F A U L T E D

Witpoortje Fault

underground

position of the

Probable

T. N.

THE WHITE REEF ON THE WEST RAND

SCALE

0 1,000 2,000 3,000 4,000 ENGLISH FEET

0 500 1000 1500 METRES

ISOPACH MAP OF THE WHITE REEF CONGLOMERATE

CONSIDERED TO REPRESENT THE

TOPOGRAPHY OF THE PRE-WHITE REEF FLOOR

AVERAGE VALUE MAP - based on average channal width values for 500ft. square blocks. Contours drawn at 10inch intervals except in the area to the west where an interval of 2 inches is used. (1FT = 0,3048 M, 1 INCH = 25,4 mm.)

Relative reliability of contours:-

—— Definite boundaries, sufficient information

—— Uncertain boundaries, limited information

---- Speculative, scanty information

Relative reliability of averages.

• Reliable (+3 sampled exposures per block)

◉ Less reliable (-3 " " " ")

○ Averages based on several borehole results

⊛ Single borehole intersection

Compiled from stoping, development and borehole sampling results by L.S.STEYN

TRENDS ON RANDFONTEIN ESTATES:

NARROW REEF

WIDER REEF

L.S.STEYN

Map 8

THE WHITE REEF ON THE WEST RAND

WEST RAND CONSOLIDATED MINES LTD.

THE LUIPAARDS VLEI ESTATE & GM. CO. LTD.

EAST CHAMP D'OR GM. CO. LTD.

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

WEST SHAFT

EAST SHAFT

WEST SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S.V. SHAFT

outcrop

T. N.

D Y K E

F A U L T E D

F A U L T E D

Witpoortje Fault underground

position of the Probable

SCALE

0 1,000 2,000 3,000 4,000 ENGLISH FEET

0 500 1000 1500 METRES

INSET INDIVIDUAL INTERSECTION VALUES

NORTH EAST SHAFT AREA

boundary

NORTH EAST SHAFT

20,000

35,000

Boreholes

Reef development

GOLD DISTRIBUTION

AVERAGE VALUE MAP-based on average inch-dwt values for 500ft. square blocks. Values contoured at 25 inch.-dwt. (108,9 cm-g.) intervals.

Relative reliability of contours:-

—— Definite boundaries, sufficient information

—— Uncertain boundaries, limited information

---- Speculative, scanty information

Relative reliability of average values:-

• Reliable (+3 sampled exposures per block)

⊛ Less reliable (-3 " " ")

○ Averages based on several borehole results.

⊙ Single borehole result.

Compiled from ore reserves-stoping, development and borehole sampling data by L.S.Steyn.

L.S. STEYN

Map Nº 9

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT

EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

T. N.

outcrop

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

F A U L T E D

D Y K E

NORTH EAST SHAFT

Witpoortje Fault underground

position of the

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

SUB-OUTCROP

2N SHAFT

32 SHAFT

SV SHAFT

Probable

80-100

70-80

>70 — red

60-70 orange

50-60 yellow

40-50 yellow

<40

THE WHITE REEF ON THE WEST RAND

SCALE

0 1,000 2,000 3,000 4,000

ENGLISH FEET

0 500 1000 1500

METRES

URANIUM DISTRIBUTION

AVERAGE VALUE MAP based on Average inch - lb. values for 500 ft. square blocks.

Contour intervals:- 10 inch-lbs. (0 270cm-kg.)
5 inch-lbs. in low value areas. (6,35cm-kg.)

Relative reliability of contours:-

—— Definite boundaries, sufficient information.

—— Uncertain boundaries, limited information.

---- Speculative, scanty information.

Relative reliability of average values:-

• Reliable (+3 sampled exposures per block)

● Less reliable (-3 " " ")

○ Averages based on several borehole intersections.

Ø Single borehole result

Compiled from ore reserves-stoping, development and borehole sampling data by L.S.STEYN

L.S.STEYN

MAP Nº 10

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT

EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

TUDOR SHAFT

CIRCULAR SHAFT

TURK SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S.V SHAFT

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

SUB-OUTCROP

Probable position of the Witpoortje Fault underground

T N.

45 000 40 000 30 000 25 000 20 000 15 000

30 000

25 000

20 000

15 000

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

THE WHITE REEF ON THE WEST RAND

SCALE

0 1000 2000 3000 4000

ENGLISH FEET

RATIO OF GOLD TO URANIUM MOVING AVERAGE MAP.

RELATIVE CONCENTATION OF GOLD TO URANIUM EXPRESSED AS DWT PER TON/ LBS PER TON. BLOCK UNITS OF 2000 SQ FEET.

• DATA POSITIONS

Compiled by L. S STEYN

MAP NO. II

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

TUDOR SHAFT

CIRCULAR SHAFT

SOUTH SHAFT

TURK SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S.V SHAFT

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

SUB-OUTCROP

Fault underground

Witpoortje

the

No information

Probable position of the

80 100 120 140 160 180

T N.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

45000 40000 30000 25000 20000 15000

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

30 000 25 000 20 000 15 000

THE WHITE REEF ON THE WEST RAND

SCALE

0 1000 2000 3000 4000

ENGLISH FEET

ISOPACH CONTOURS : MONARCH-WHITE REEF (UNITS IN FEET)

AXIS OF MAXIMUM THICKENING

After Toens and Griffiths (1964)

Map 12

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT

EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

TUDOR SHAFT

CIRCULAR SHAFT

TURK SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S.V. SHAFT

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

outcrop

sub-outcrop

T. N.

the Witpoortje Fault

the Position

the Probable

45000 40000 30000 25000 20000 15000

30,000 25,000 20,000 15.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

THE WHITE REEF ON THE WEST RAND

SCALE

0 1,000 2,000 3,000 4,000 ENGLISH FEET

0 500 METRES 1000 1500

ORIENTATION OF SEDIMENTARY STRUCTURES

AVERAGE AZIMUTH DIRECTIONS OF INDIVIDUAL CROSS-BEDDED UNITS:-

- Planar cross-bedding in overlying quartzites
- Trough cross-bedding in overlying quartzites
- Planar cross-bedding in White Reef conglomerate
- Trough cross-bedding in White Reef conglomerate
- Planar cross-bedding in underlying quartzites
- Trough cross-bedding in underlying quartzites

A minimum of 3 cross-sets measured per unit.

- Orientation of symmetrical ripple-mark axes
- Orientation of asymmetrical ripple-mark axes
- Orientation of symmetrical sandwave axes

All measurements stratigraphically within a zone of 5ft. from the White Reef.

Mapped & drawn by L.S.STEYN

Map 13

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT

EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

T. N.

outcrop

outcrop

outcrop

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

SUB-OUTCROP

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

2N SHAFT

32 SHAFT

S.V. SHAFT

45000 40000 30000 25000 20000 15000

30,000

25,000

20,000

15,

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

THE WHITE REEF ON THE WEST RAND

SCALE

0 1,000 2,000 3,000 4,000

ENGLISH FEET

PRE-WHITE REEF PALEOCURRENT PATTERN

EXPLANATION

→ MOVING AVERAGE. AZIMUTH DIRECTION OF RESULTANT VECTOR.

100 80 60 40 20 — VECTOR MAGNITUDE AS A PERCENTAGE OF THE AZIMUTH CONSTITUENCY RATIO.

• MEASURING LOCALITIES.

L.S. STEYN

MAP Nº 14

THE WHITE REEF ON THE WEST RAND

WEST RAND CONSOLIDATED MINES LTD.

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

EAST CHAMP D'OR G.M. CO. LTD.

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

WEST SHAFT

EAST SHAFT

WEST SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

2N SHAFT

32 SHAFT

S.V SHAFT

DYKE

FAULTED

FAULTED

Witpoortje Fault underground

Probable position of the SUB-OUTCROP

T N.

SCALE

0 1000 2000 3000 4000

ENGLISH FEET

MEAN SIZE OF CONGLOMERATE PEBBLES

AVERAGE SIZE OF PEBBLES CONTOURED AT 1mm INTERVALS

——— RELIABLE CONTOURS

– – – – UNCERTAIN CONTOURS

---------- SPECULATIVE CONTOURS

Compiled by L. S STEYN

MAP Nº 14-a

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT

EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S.V SHAFT

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

SUB-OUTCROP

Witpoortje Fault underground

Position of the Probable

T N

45 000 40 000 30 000 25 000 20 000 15 000

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

30 000 25 000 20 000 15 000

THE WHITE REEF ON THE WEST RAND

SCALE

0 1000 2000 3000 4000

ENGLISH FEET

MEAN SIZE OF CONGLOMERATE PEBBLES DATA MAP

AVERAGE SIZE OF ALL PEBBLES MEASURED IN 6" WIDE SECTION ACROSS THE CHANNEL WIDTH.

PEBBLES DEFINED AS LONG AXIS > 4mm.

• MEASURING STATIONS

Compiled by L. S STEYN

MAP Nº 15

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S.V SHAFT

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

SUB-OUTCROP

Witpoortje Fault underground

Probable position of the

T N.

45 000 40 000 30 000 25 000 20 000 15 000

30 000 25 000 20 000 15 000

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

THE WHITE REEF ON THE WEST RAND

SCALE

0 1000 2000 3000 4000

ENGLISH FEET

SIZE SORTING OF PEBBLES

Contours of standard deviation of mean pebble size, 1mm interval.

• Data position

Compiled by L.S STEYN

MAP Nº 15a

WEST RAND CONSOLIDATED MINES LTD.

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

EAST CHAMP D'OR G.M. CO. LTD.

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

WEST SHAFT

EAST SHAFT

WEST SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S V SHAFT

SUB-OUTCROP

Witpoortje Fault underground

Probable position of the

T N

45 000 40 000 30 000 25 000 20 000 15 000

30 000

25 000

20 000

15 000

THE WHITE REEF ON THE WEST RAND

SCALE

0 1000 2000 3000 4000

ENGLISH FEET

SIZE SORTING OF PEBBLES

Data Map: Standard deviations of mean pebble sizes in mm.

• Data position

Compiled by L. S STEYN

Map 16

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

T. N.

outcrop

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S.V. SHAFT

Faulted

Boortje Fault

underground

Position of the Probable

SUB-OUTCROP

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

THE WHITE REEF ON THE WEST RAND

SCALE

0 1,000 2,000 3,000 4,000 ENGLISH FEET

0 500 1000 1500 METRES

PACKING DENSITY OF PEBBLES

EXPLANATION: THE RATIO OF PEBBLES TO MATRIX, IN A STRIP ACROSS THE WIDTH OF THE CONGLOMERATE IS EXPRESSED AS A PERCENTAGE. VALUES CONTOURED AT 10% INTERVALS.

- Measuring stations
- Definite boundaries, sufficient information
- Uncertain boundaries, limited information
- Postulated boundaries, scanty information

Mapped & drawn by L.S.STEYN

Map 17

PEBBLE SPHERICITIES AND INCLINATIONS IN THE WHITE REEF ON THE WEST RAND.

WEST RAND CONSOLIDATED MINES LTD.

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

EAST CHAMP D'OR G.M. CO. LTD.

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

WEST SHAFT

EAST SHAFT

WEST SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

2N SHAFT

32 SHAFT

S.V. SHAFT

outcrop

sub-outcrop

BOUNDARIES SEPARATING 3 ZONES OF PEBBLES INFLUX FACIES.

T. N.

SCALE

0 1,000 2,000 3,000 4,000 ENGLISH FEET

0 500 1000 1500 METRES

EXPLANATION:

PEBBLE SHAPE — TRUE SPHERICITY Measurements of loose pebbles

APPARENT SPHERICITY Measurements of 2 dimensional exposures

PEBBLE ORIENTATION — 50% / 24° Direction of majority pebble inclination

50% Percentage of pebbles dipping in indicated direction

24° Average angle of pebble inclination

L.S. STEYN

Map 18

THE WHITE REEF ON THE WEST RAND

WEST RAND CONSOLIDATED MINES LTD.

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

EAST CHAMP D'OR G.M. CO. LTD.

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

WEST SHAFT

EAST SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S.V. SHAFT

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

T. N.

MILKY WHITE QRTZ 50%+

CHERT 15%

CHERT 15-21%

outcrop

QUARTZITE DEFICIENT 10%-

MILKY WHITE QRTZ 20%+

MISCELLANEOUS 10%+

CHERT 10%+

SUB-OUTCROP

WEST RAND FACIES

LUIPAARDS VLEI FACIES

RANDFONTEIN FACIES

SCALE

0 1,000 2,000 3,000 4,000 ENGLISH FEET

0 500 1000 1500 METRES

COMPOSITION OF CONGLOMERATE PEBBLES

Relative abundance of the various types of pebbles, expressed as percentages.
Sampling covers equal areas across the width of the conglomerate.
Contour intervals for quartzite pebbles: 10%

Order of pebble percentages:
1. Quartzite
2. Miscellaneous
3. Chert
4. Milky white quartz
5. Other quartz types

• Sampling localities

L.S. STEYN

Map 19

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT

EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

TUDOR SHAFT

CIRCULAR SHAFT

TURK SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S.V. SHAFT

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

outcrop

SUB-OUTCROP

T.N.

45000 40000 30000 25000 20000 15000

30,000

25,000

20,000

15.

THE WHITE REEF ON THE WEST RAND

SCALE

0 1,000 2,000 3,000 4,000

ENGLISH FEET

WHITE REEF

PALEOCURRENT PATTERN.

EXPLANATION

MOVING AVERAGE. AZIMUTH DIRECTION OF RESULTANT VECTOR.

100 80 60 40 20 10

VECTOR MAGNITUDE AS A PERCENTAGE OF THE AZIMUTH CONSISTANCY RATIO.

MEASURING LOCALITIES.

L.S. STEYN

Map 20

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT

EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

TUDOR SHAFT

CIRCULAR SHAFT

TURK SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S.V. SHAFT

THE RANDFONTEIN ESTATES G.M. CO. LTD.

outcrop

SUB-OUTCROP

T.N.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

45000 40000 35000 30000 25000 20000 15000

30000 25000 20000 15

THE WHITE REEF ON THE WEST RAND

SCALE

0 1,000 2,000 3,000 4,000

ENGLISH FEET

POST-WHITE REEF PALEOCURRENT PATTERN

EXPLANATION.

→ MOVING AVERAGE. AZIMUTH DIRECTION OF RESULTANT VECTOR.

100 80 60 40 20 0 — VECTOR MAGNITUDE AS A PERCENTAGE OF THE AZIMUTH CONSISTANCY RATIO.

• MEASURING LOCALITIES.

L.S. STEYN

MAP Nº 21

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT

EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

2N SHAFT

2 SHAFT

SV SHAFT

SUB-OUTCROP

Witpoortje Fault underground

Probable position of the

T N.

45 000 40 000 30 000 25 000 20 000 15 000

30 000 25 000 20 000 15 000

THE WHITE REEF ON THE WEST RAND

SCALE

0 1000 2000 3000 4000

ENGLISH FEET

EROSIONAL SCOURS ON THE FLOOR OF THE WHITE REEF.

Compiled by L S STEYN

MAP Nº 22

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT

EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S.V. SHAFT

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

SUB-OUTCROP

Witpoortje Fault underground

Probable position of the

T N.

45 000 40 000 30 000 20 000 15 000

30 000

25 000

20 000

15 000

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

THE WHITE REEF ON THE WEST RAND

SCALE

0 1000 2000 3000 4000

ENGLISH FEET

FOLD TRENDS AT VARIOUS LEVELS.

- SYNCLINE
- ANTICLINE
- WHITE REEF ISOPACHS
- WHITE REEF STRUCTURE
- MAIN REEF STRUCTURE
- SOUTH-MAIN REEF ISOPACHS
- MONARCH-WHITE REEF ISOPACHS

ZONES OF MAIN MINERALISATION

WHITE REEF PALEO-CURRENTS

Compiled by L S STEYN

MAP Nº 23

WEST RAND CONSOLIDATED MINES LTD.

WEST SHAFT

EAST SHAFT

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

WEST SHAFT

T.N.

A (56 STATIONS)

SOUTH SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

C (32 STATIONS)

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

EAST CHAMP D'OR G.M. CO. LTD.

Fault underground

NORTH EAST SHAFT

Witpoortje

SUB-OUTCROP

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

2N SHAFT

B (11 STATIONS)

32 SHAFT

Position of the Probable

S.V SHAFT

THE WHITE REEF ON THE WEST RAND

SCALE

0 1000 2000 3000 4000

ENGLISH FEET

PALEO - CURRENT AZIMUTHS OF CROSS-BEDDING MEASURED IN THE WHITE REEF.

D TOTAL WHITE REEF (99 STATIONS).

SYNCLINE PLUNGE 186° AT 22°

Compiled by L. S. STEYN

MAP 24

THE WHITE REEF ON THE WEST RAND

WEST RAND CONSOLIDATED MINES LTD.

THE LUIPAARDS VLEI ESTATE & G.M. CO. LTD.

EAST CHAMP D'OR G.M. CO. LTD.

THE RANDFONTEIN ESTATES G.M. CO.(W.) LTD.

WEST SHAFT

EAST SHAFT

T.N.

outcrop

SOUTH SHAFT

No 2 INCLINE SHAFT

16 SHAFT

MONARCH SHAFT

DEEP SHAFT

NORTH EAST SHAFT

2N SHAFT

32 SHAFT

S.V. SHAFT

TURK SHAFT

TUDOR SHAFT

CIRCULAR SHAFT

FAULTED

Witpoortje Fault

underground

Position of the Probable

SCALE

0 1000 2000 3000 4000 ENGLISH FEET

0 500 1000 1500 METRES

PREDICTED ZONES OF MAXIMUM MINERALIZATION

Based on consideration of all sedimentological properties.

- Decreasing mineralization.
- Suggested extension directions of mineralised zones.
- (A) - (J) Predicted zones of high mineralisation (1965.)
- Surface outcrops.
- Underground development on White Reef.
- Underground development to reef.
- Stoped areas (1965.) Later mining until 1974
- Borehole intersections.
- 23 Mine level numbers.

MONARCH SHAFT

EXTENT OF MINING AS AT 31st DECEMBER 1974 (Scale 1:10 000)

Compiled by L.S.STEYN