

Case Study on Practical Conversion of Exploration Data to UNFC codes :

**K Shashidharan
GSI, Kolkata**

EXPLORATION STAGES FOLLOWED BY GSI PRIOR TO ADOPTION OF UNFC

P1 :Remote sensing, Aerial geophysics, Large scale mapping, Geochemical, Ground geophysics, P/ T

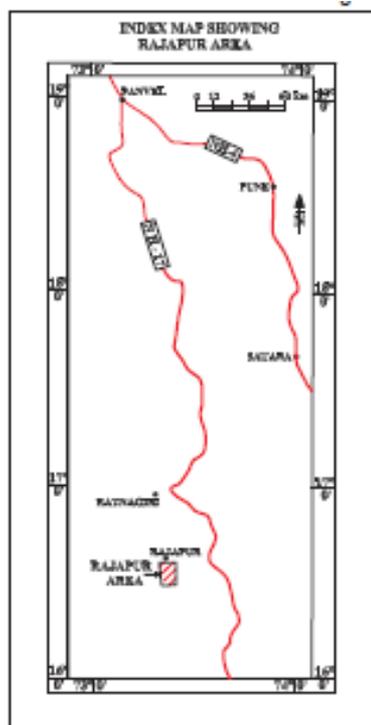
P2:Large scale mapping, Detailed Mapping, Geochemical, Ground geophysics, closer spaced P/T. Scout drilling.

E1: Detailed mapping,(1:5000- 1:2000), P/T, Drilling at closer intervals, Petrography, Petro minerography.

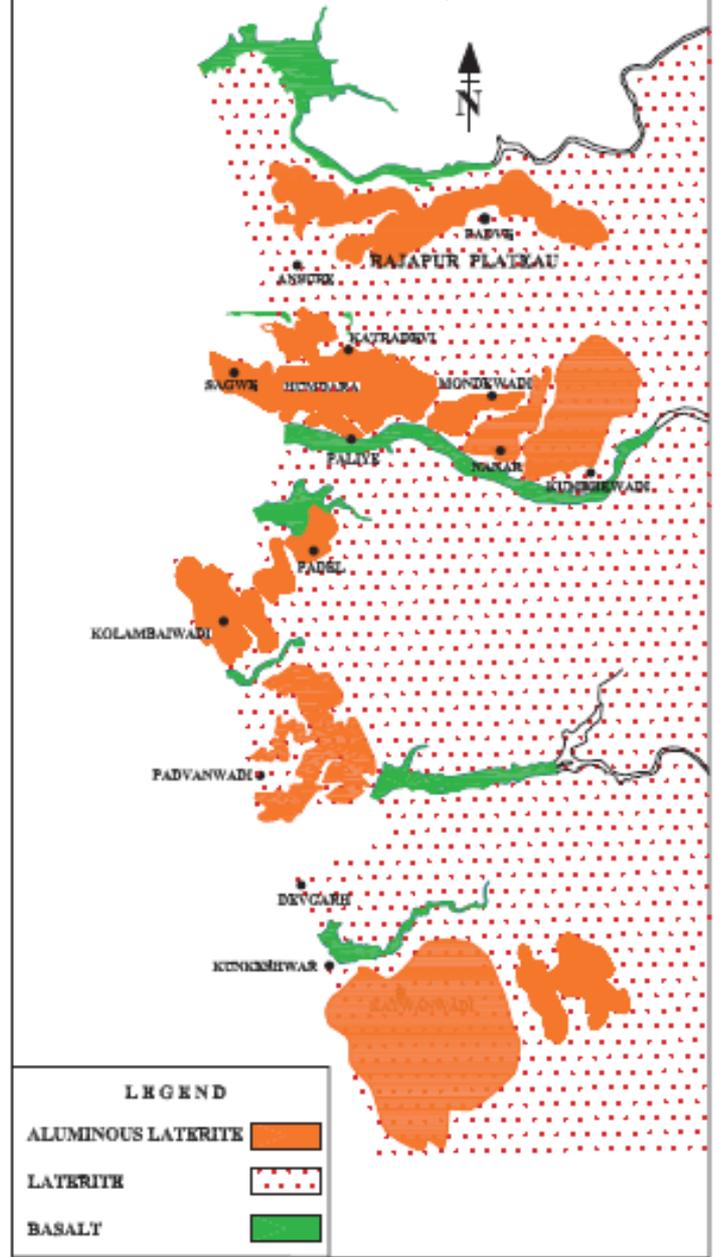
E2: Detailed mapping(1:2000- 1:1000), P/T at closer intervals, Close spaced drilling at two levels , Core sampling, Detailed Petrography, Petrominerography.

UNFC - Geological axis

| | Work component |
|-----------|--|
| G4 | Aerial reconnaissance, Geol. Mapping on 50,000 or smaller scales, Geochem, Geophysical, P/T and Petrological studies |
| G3 | Mapping on 50,000 -25000 scales(10000 scale for coal ,lignite), Detailed Geochem. sampling, Detailed geophysics, P/T , Drilling (1000-2000 for coal& lignite to 300-400m for bauxite to 100-200 m for structurally complex metallic minerals)and Petrominerography |
| G2 | Mapping on 25000 to 1000 scale with topographical mapping, detailed litho- geochemistry, detailed geophysical survey including borehole GP, close spaced trenching, close spaced drilling (200-50m), detailed petrography, baseline environmental data. |
| G1 | Detailed topography cum, geological Mapping on 5000-1000scales, grid pattern geochem sampling, detailed and specific borehole GP surveys, close spaced P/T, drilling(100X 50m grids, and at 3-4 levels of drilling, bulk sampling for beneficiation, detailed petrographic studies of ore and host rocks, Geostatistics. |



SKETCH MAP OF LATERITE CAPPINGS IN AND AROUND RAJAPUR - DEVGARH AREA, RATNAGIRI AND SINDHUDURG DISTRICTS, MAHARASHTRA



Stratigraphy

| | |
|--|---|
| | |
| Laterite with bauxite pockets | Miocene/ Pliocene to Quaternary |
| Clay with peat and lignite seams | Middle Eocene= Warkali beds |
| Purandaragarh Fm Sahyadri Group (Deccan Trap) | Upper Cretaceous to Lower Eocene |
| Kaladgi Group | Precambrian |

WORK QUANTUM

| Name of the block | LSM 12500 | Detailed Mapping (sq km) 2000) | Groove sample | Drilling | Core sample |
|----------------------|--------------|--------------------------------------|---------------|----------|-------------|
| Ghodepawaiwadi block | 35 sq. km | 1.7 | 9 | 33 | 163 |
| Humdara block | | 1.9 | 14 | 24 | 181 |
| Kumbhawade: A | | 0.7 | 3 | 52 | 342 |
| Kumbhawade: B | | 0.9 | - | 45 | 126 |
| Kumbhawade: C | | 3.95 | - | 222 | 208 |
| Kumbhawade: D | | 1.5 | - | 52 | 208 |

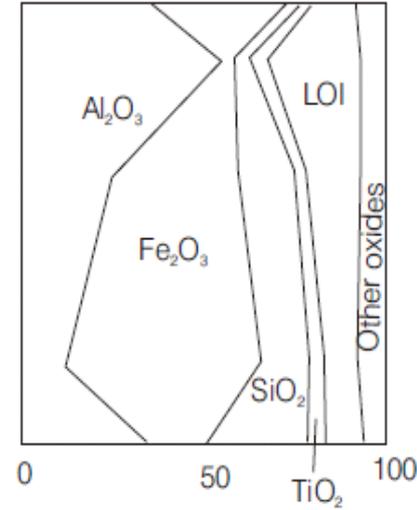
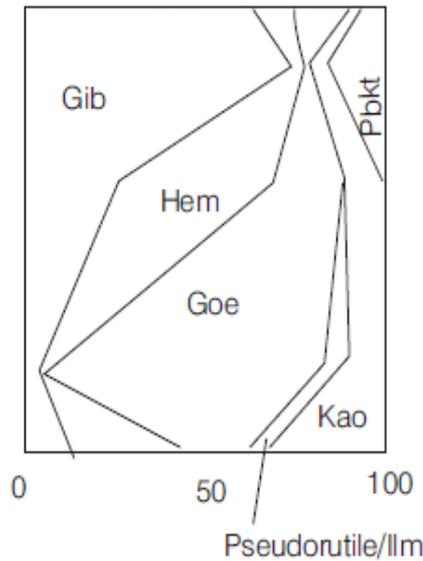
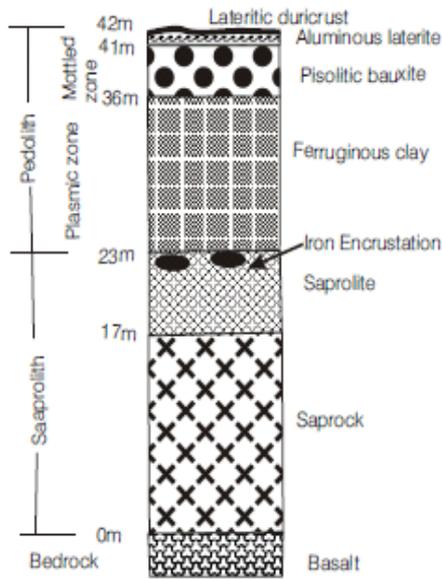
Exploration pattern

- Large scale mapping(12,500), Detailed mapping (2000)
- *Borehole spacing: 100 m in majority cases*
- *In one block 200m spacing (Nanar block)*
- *Occasional pitting (due to intense cultivation)*
- *Grab samples and groove samples collected where ever exposed along plateau cut by gullies.*
- *Detailed soil profile studies -across the plateaus and mineralogical studies of the ore and gangue by XRD, SEM, and EPMA.*
- *Baseline environmental data collection done pertaining to air, surface & ground water quality , meteorology, land use- land cover pattern, agricultural – irrigation and on forest cover and vegetation pattern.*

GEOLOGICAL MAP OF RAJAPUR LATERITE CAPPING SHOWING OCCURRENCES OF BAUXITE & ALUMINOUS LATERITE

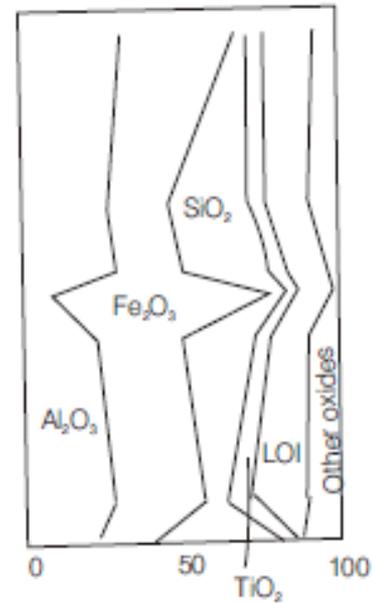
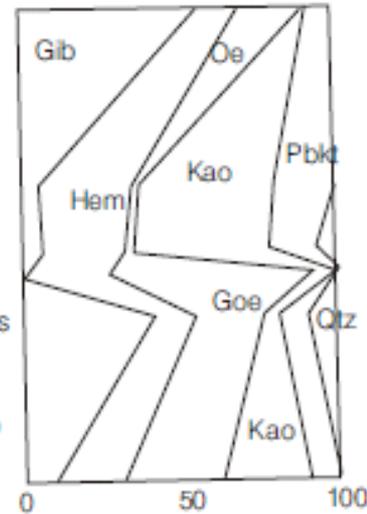
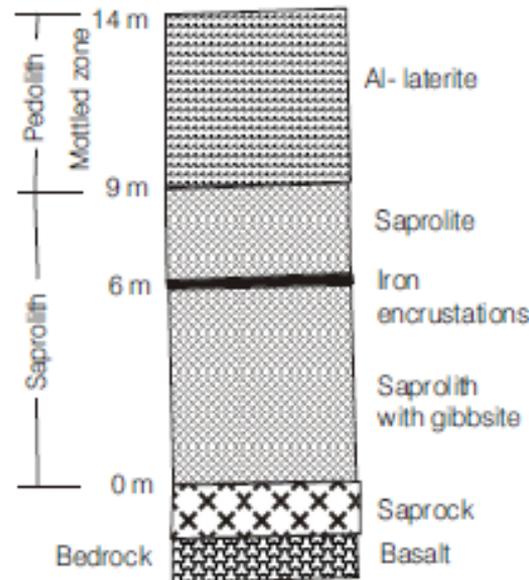
SCALE - 1:10000
0 250 500 m





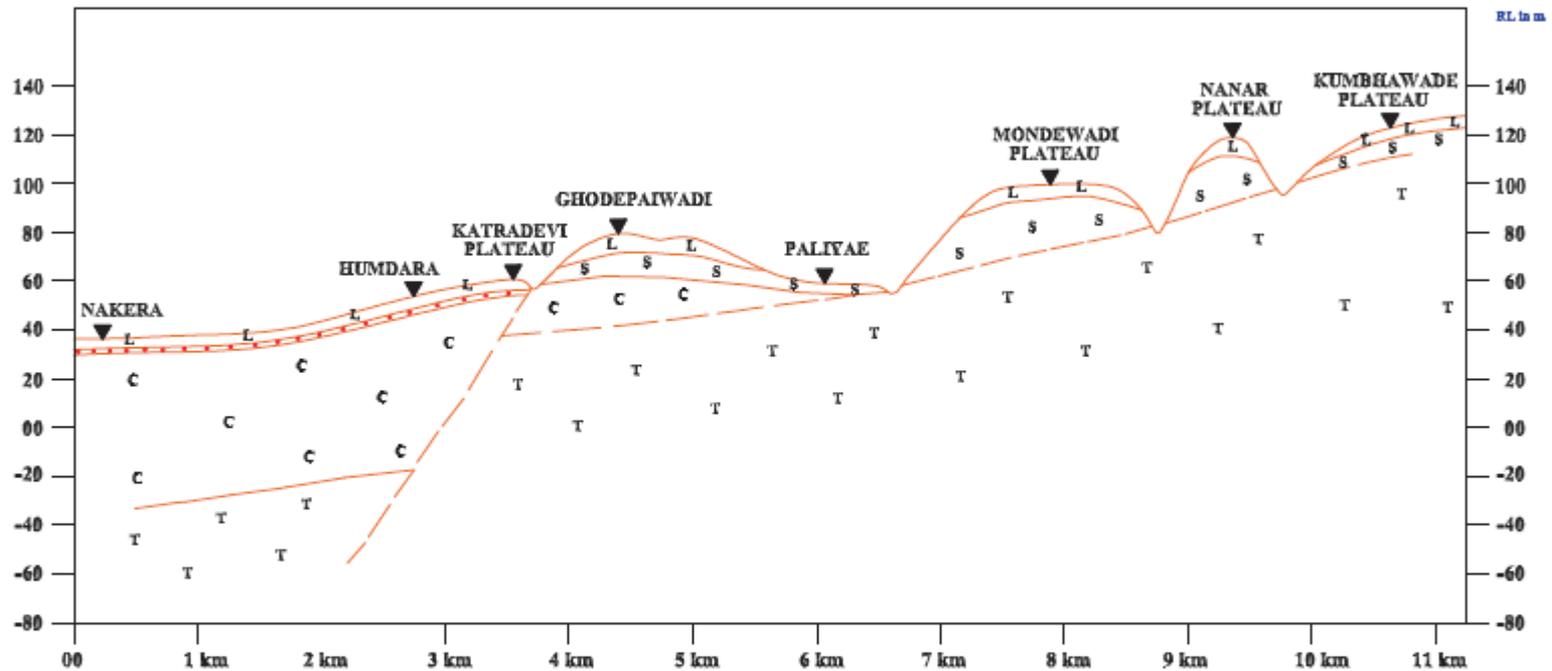
Kumbhawade Profile showing mineralogical and chemical variation

Padve Profile showing mineralogical and chemical variation.



GEOLOGICAL SURVEY OF INDIA
GEOLOGICAL SECTION FROM KATRADEVI TO KUMBHAWADE PLATEAU

RL
in
m

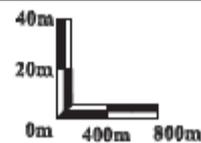


RL in m

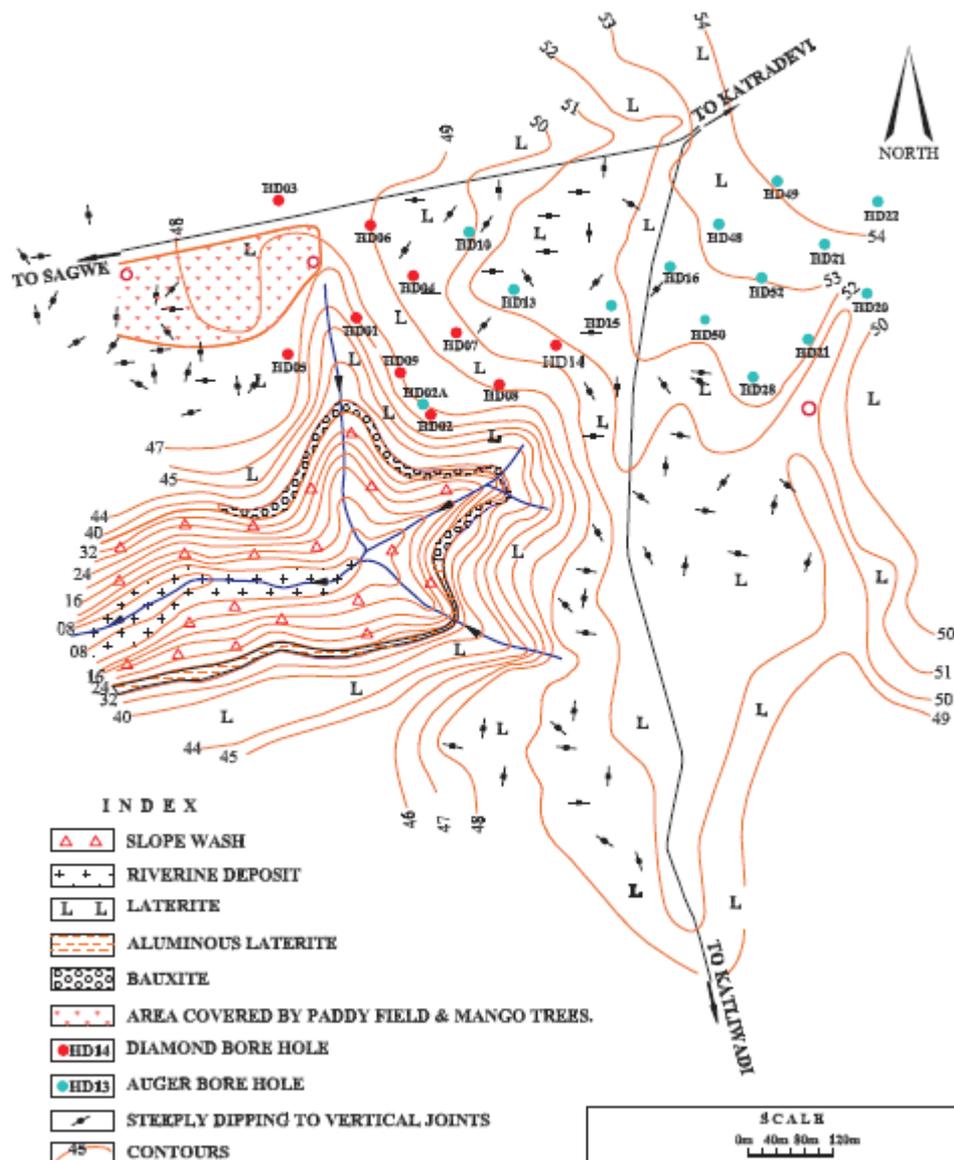
I N D E X

| | |
|-----------------------------|-------|
| LATERITE | L L |
| BAUXITE /ALUMINOUS LATERITE | ••••• |
| CLAY | C C |
| SAPROLITE | S S |
| BASALT | T T |

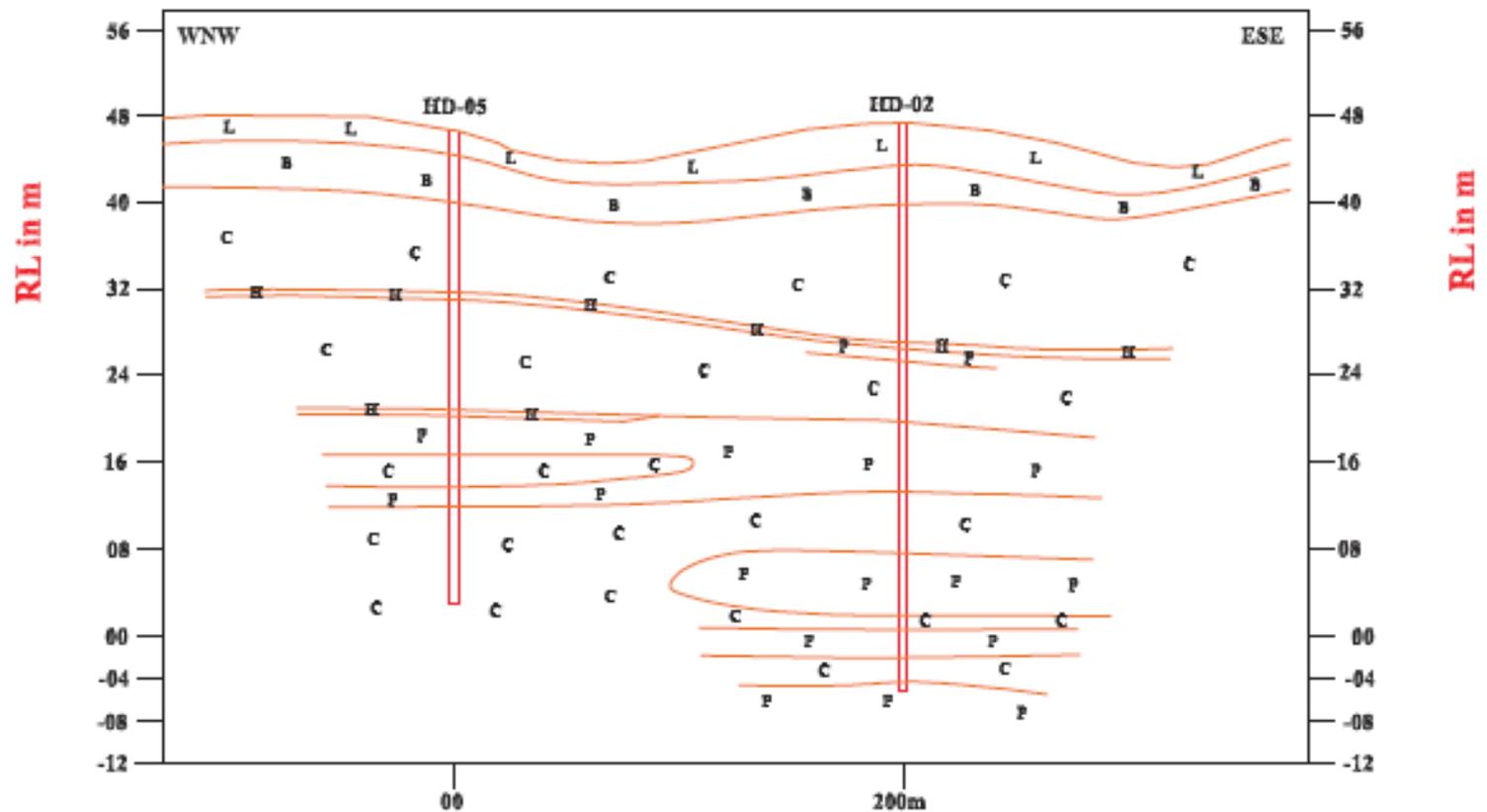
S C A L E



GEOLOGICAL SURVEY OF INDIA
**GEOLOGICAL MAP OF HUMDARA AREA OF KATRADEVI PLATEAU
 RATNAGIRI DISTRICT, MAHARASHTRA.**



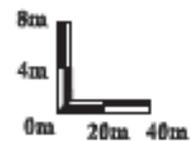
GEOLOGICAL SECTION ACROSS HUMDARA VALLEY, KATRADEVI PLATEAU.



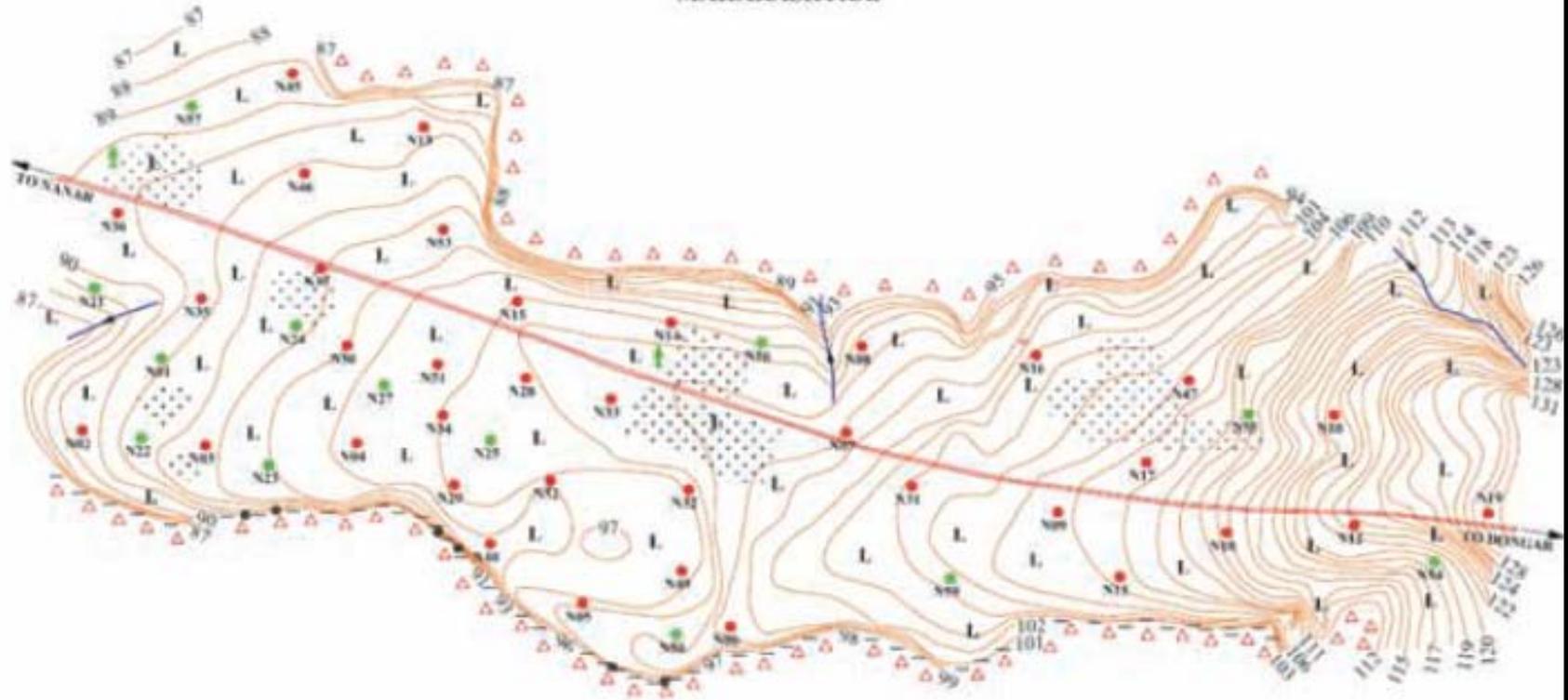
INDEX

| | |
|-----------------------------|-----|
| LATERITE | L L |
| BAUXITE /ALUMINOUS LATERITE | B B |
| CLAY | C C |
| IRON PAN | H H |
| PEAT | P P |

SCALE

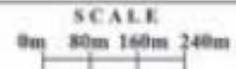


GEOLOGICAL SURVEY OF INDIA
**GEOLOGICAL MAP OF NANAR AREA, TALUKA-RAJAPUR, DISTRICT-RATNAGIRI
 MAHARASHTRA.**

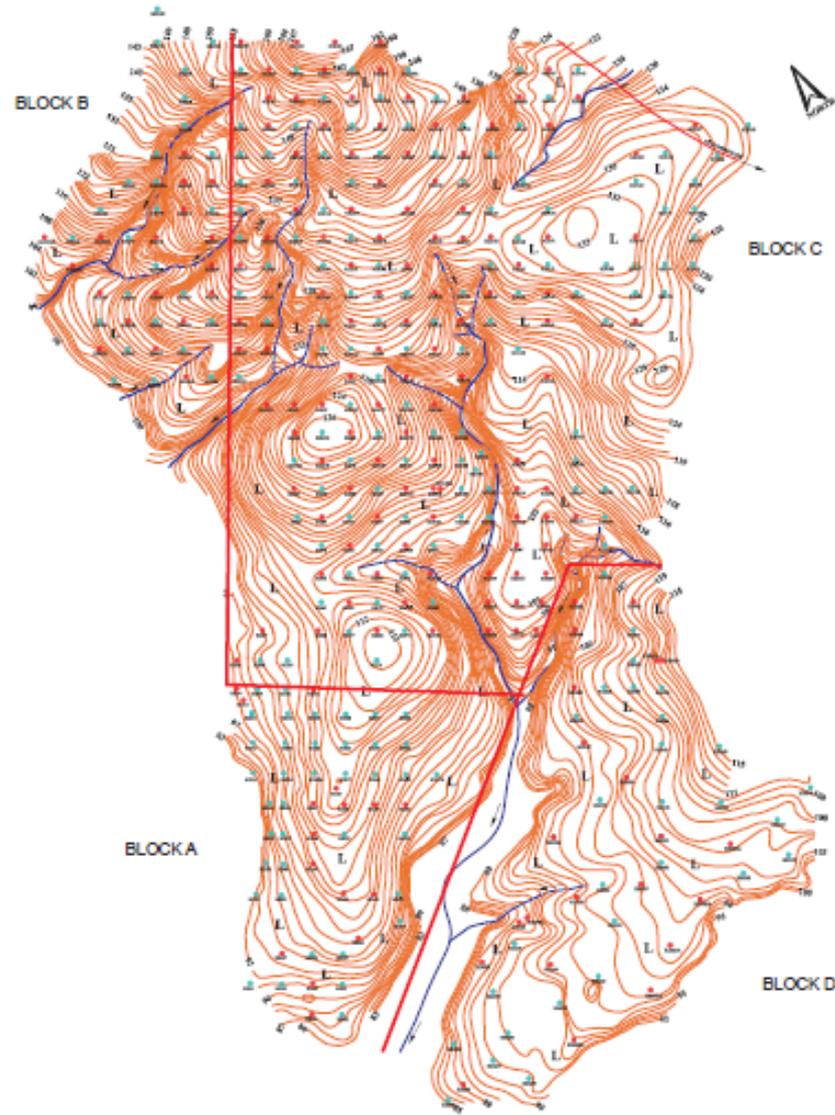


I N D E X

| | | | |
|--------------------|-----|-------------------|-------|
| SLOPE WASH | △ △ | DIAMOND BORE HOLE | ● N23 |
| LATERITE | L L | AUGER BORE HOLE | ● N34 |
| ALUMINOUS LATERITE | — — | CONTOURS | 45 |
| BAUXITE | ● ● | ROAD | — — |
| PADDY FIELD | ○ ○ | WELL | ○ |
| | | STRUCTURE | □ |



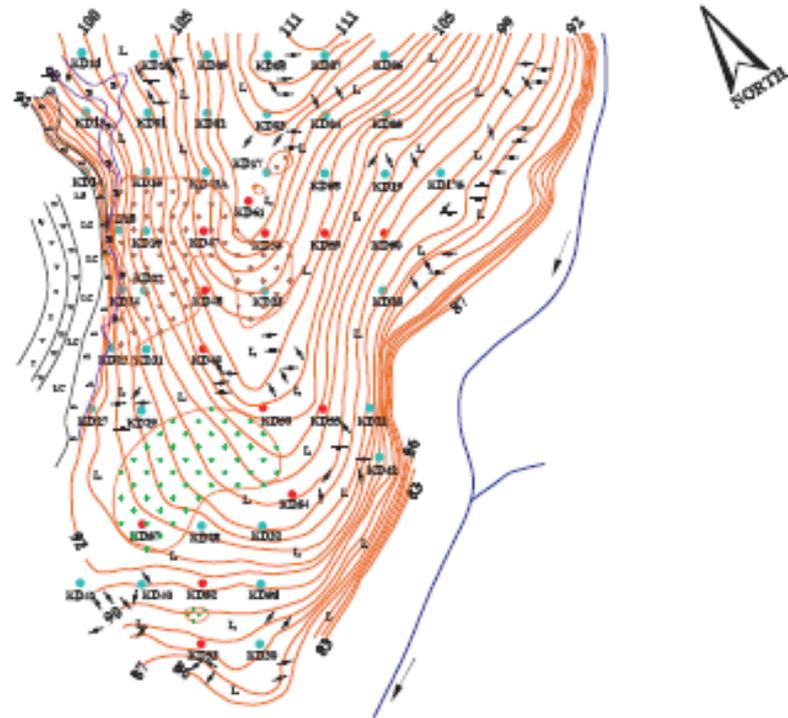
GEOLOGICAL SURVEY OF INDIA
 GEOLOGICAL MAP OF KUMBHAWADE PLATEAU, DIST-RATNAGIRI, MAHARASHTRA



| INDEX | | | | SCALE |
|------------------------------------|-----|-------------------|---------|-------------|
| LATERITE | L L | DIAMOND BORE HOLE | ● KD320 | 1 cm = 1 km |
| SOIL/PADY FIELD | □ | AUGER BORE HOLE | ● KD362 | |
| MANGO GARDEN | □ | CONTOURS | 45 | |
| STEEPLY DIPPING TO VERTICAL JOINTS | ↘ | ROAD | — | |
| | □ | WELL | ○ | |



GEOLOGICAL SURVEY OF INDIA
GEOLOGICAL MAP OF KUMBHAWADE PLATEAU, BLOCK- A
RATNAGIRI DISTRICT, MAHARASHTRA.



I N D E X

| | | | |
|--------------------|-------|--|---------|
| LATERITE | L L | AREA COVERED BY PARTLY PADDY FIELD & MANGO TREES | |
| BAUXITE | ■ ■ ■ | STEPLY DIPPING TO VERTICAL JOINTS | |
| LITHOMARGE CLAY | LC LC | DIAMOND BORE HOLE | ● KD329 |
| ALUMINOUS LATERITE | ~ ~ ~ | AUGER BORE HOLE | ● KD362 |
| SAPROLITE ZONE | ~ ~ ~ | CONTOURS | 45 |
| BASALT | □ □ □ | | |

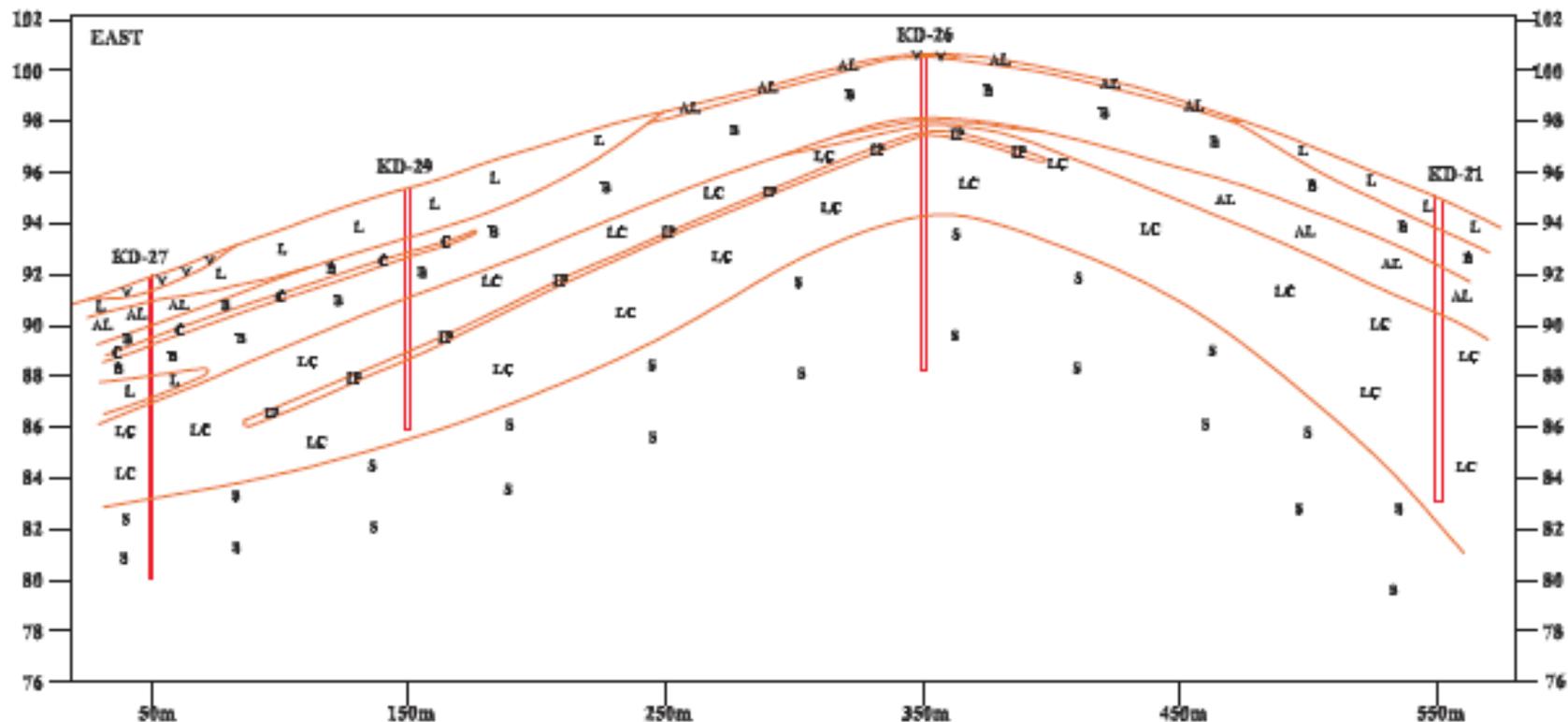
SCALE
 1 cm = 4 km 500 m 1000 m

GEOLOGICAL SURVEY OF INDIA

E-W GEOLOGICAL SECTION ACROSS KUMBHAWADE PLATEAU, BLOCK-A
BETWEEN BH. KD27 AND KD21

RL in m

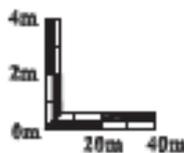
RL in m



I N D E X

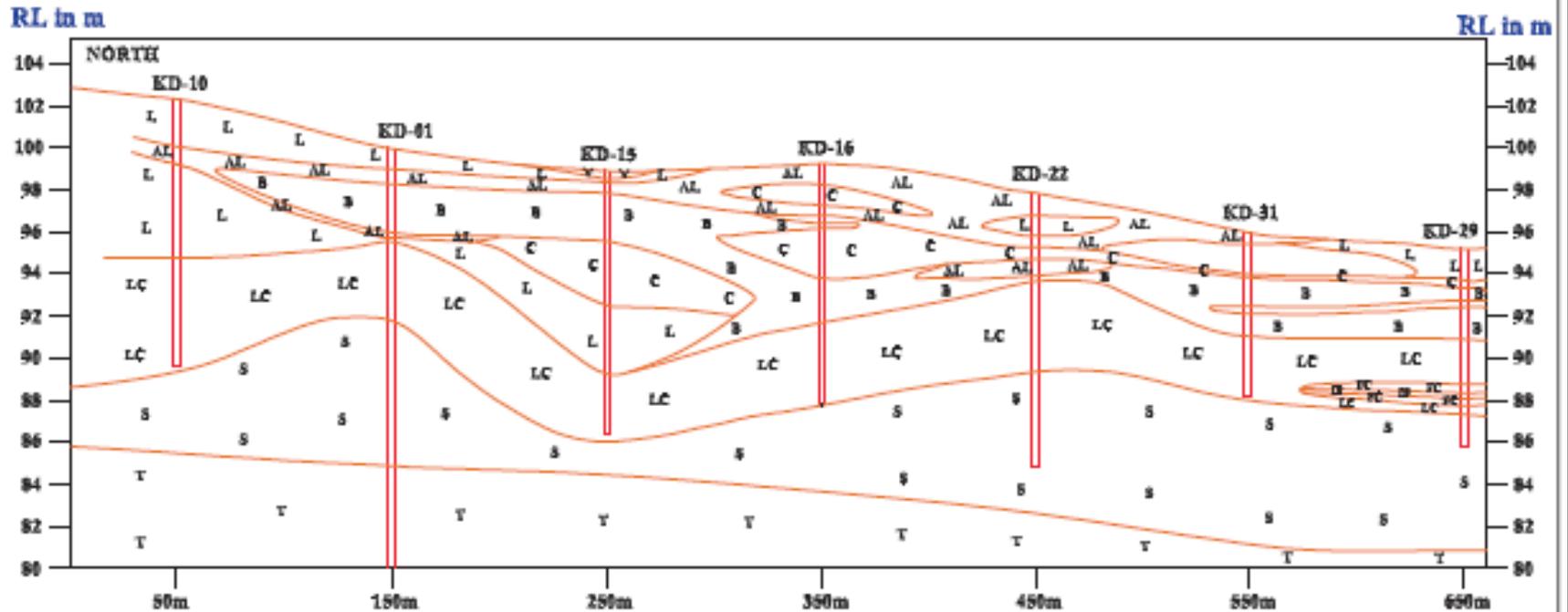
S C A L E

| | | | |
|--------------------|-------|--------------------|-------|
| SOIL | v v | CLAY (ALUMINOUS ?) | c c |
| LATERITE | L L | LITHOMARGE CLAY | LC LC |
| ALUMINOUS LATERITE | AL AL | SAPROLITE | S S |
| BAUXITE | B B | | |
| IRON PAN | IP IP | | |



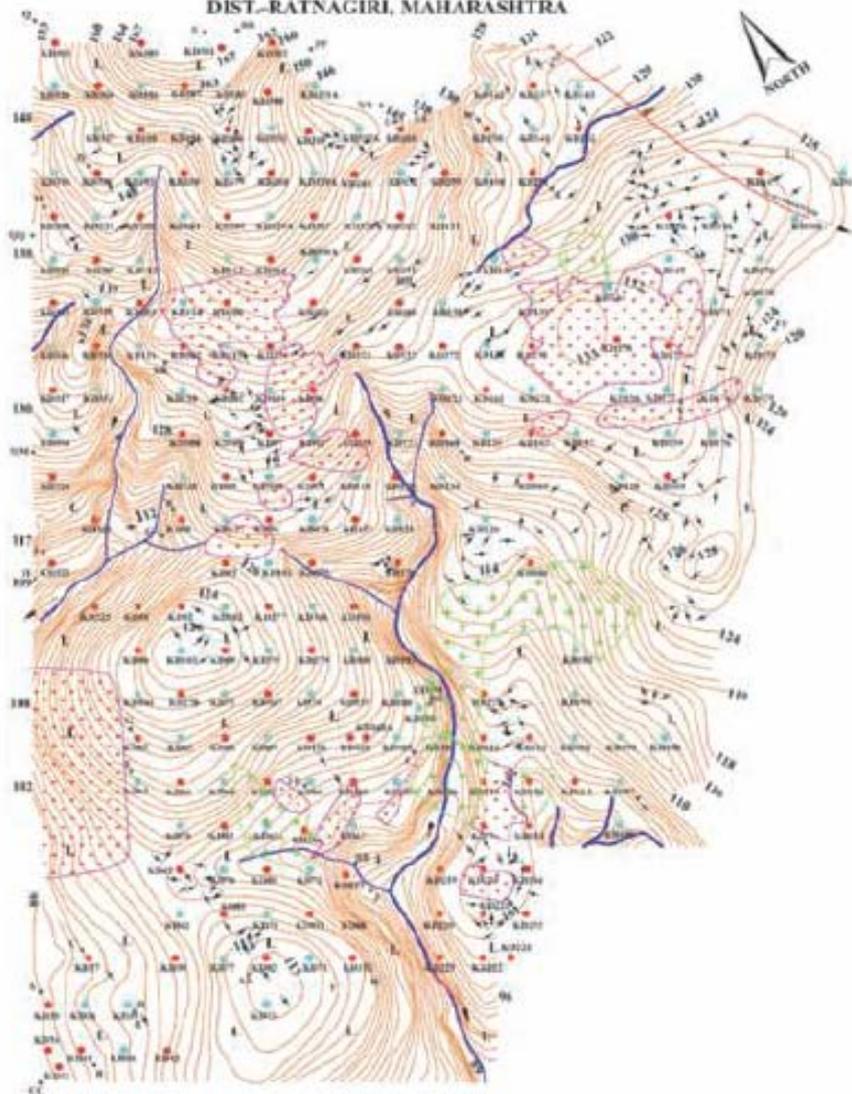
GEOLOGICAL SURVEY OF INDIA

N - S GEOLOGICAL SECTION ACROSS KUMBHAWADE PLATEAU, BLOCK 'A'



| INDEX | | | | SCALE | |
|--------------------|-------|--------------------------------|-------|-------|--|
| SOIL | V V | LITHOMARGE CLAY | LC LC | | |
| LATERITE | L L | IRON PAN WITH FERRUGINOUS CLAY | IP FC | | |
| ALUMINOUS LATERITE | AL AL | SAPROLITE | S S | | |
| BAUXITE | B B | BASALT | T T | | |
| CLAY (BAUXITIC ?) | C C | | | | |

GEOLOGICAL SURVEY OF INDIA
GEOLOGICAL MAP OF KUMBHAWADE PLATEAU, BLOCK-C
DIST.-RATNAGIRI, MAHARASHTRA

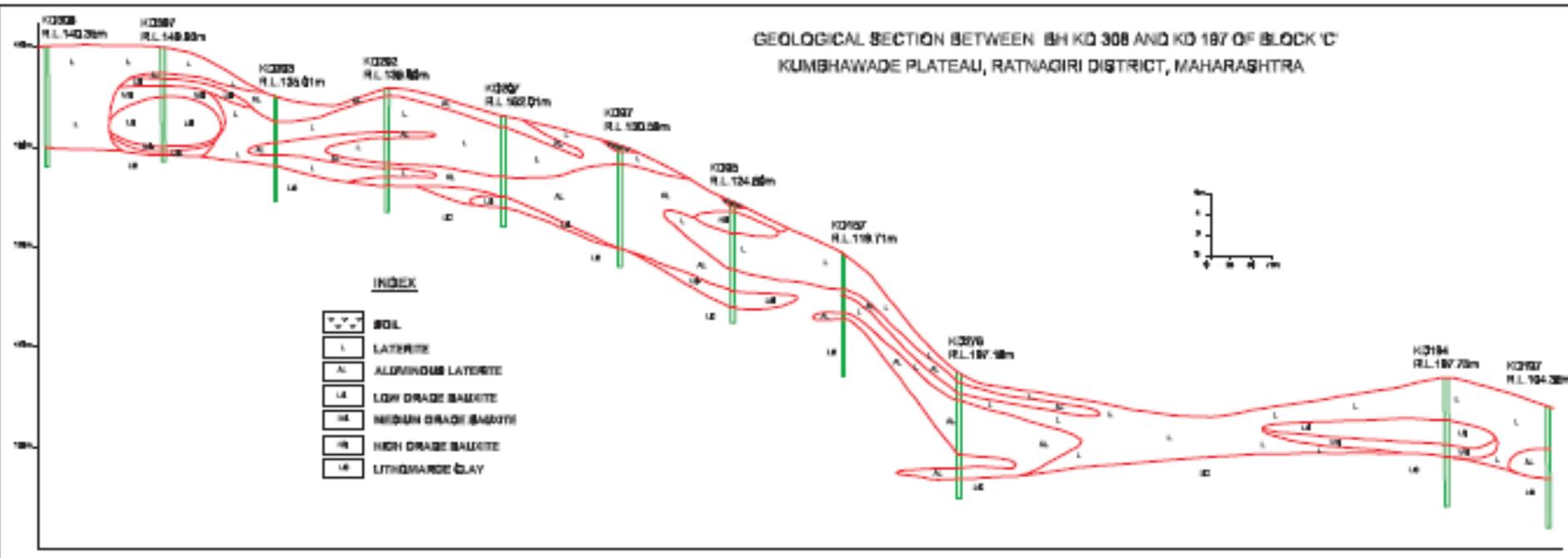


INDEX

| | | | |
|---|-------|-------------------|---------|
| LATERITE | L L | DIAMOND BORE HOLE | ● KDS20 |
| AREA COVERED BY PARTLY PADDY FIELD & MANGO TREES. | □ □ □ | AUGER BORE HOLE | ● KDS62 |
| MANGO GARDEN | □ □ □ | CONTOURS | 45 |
| STEEPLY DIPPING TO VERTICAL JOINTS | — | ROAD | — |
| | | WELL | ○ |

SCALE
 0m 50m 100m

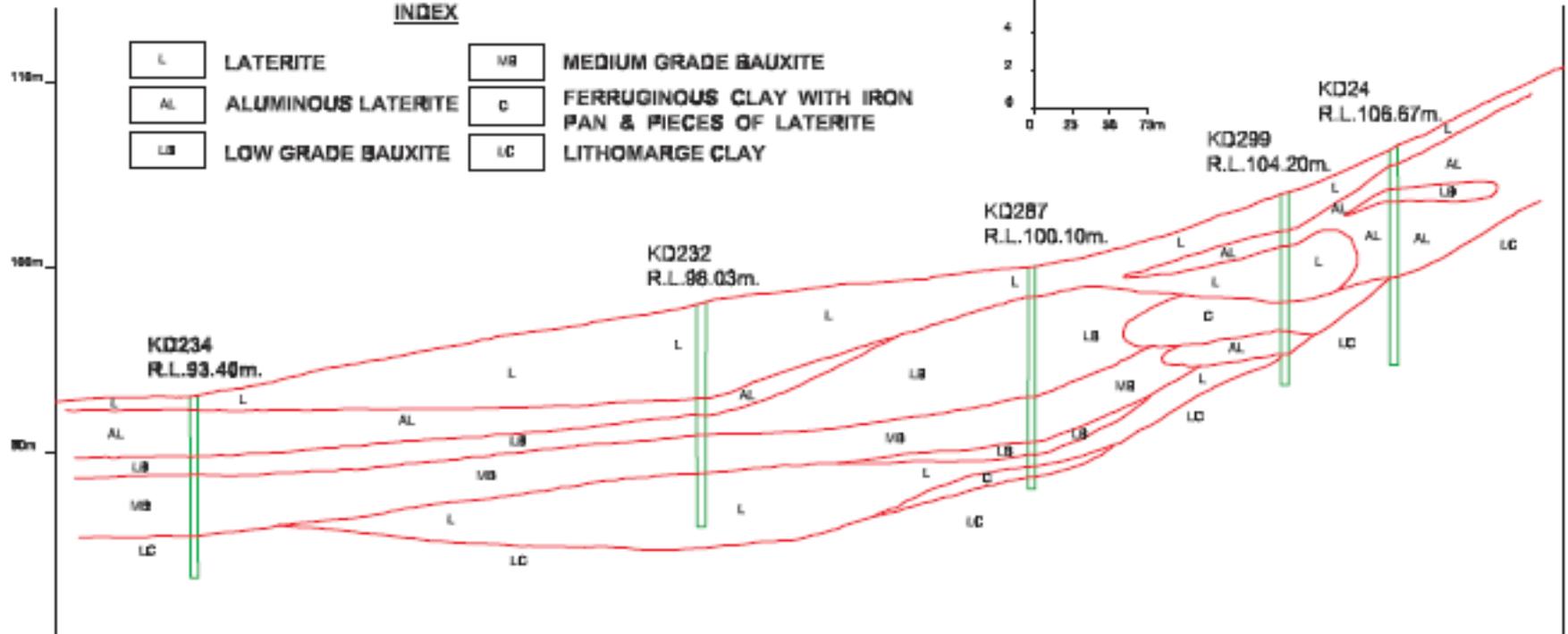
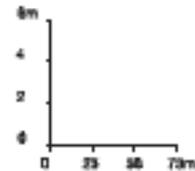
GEOLOGICAL SECTION BETWEEN BH KD 308 AND KD 187 OF BLOCK 'C'
 KUMBHAWADE PLATEAU, RATNAGIRI DISTRICT, MAHARASHTRA



GEOLOGICAL SECTION BETWEEN BH KD234 AND KD24 OF BLOCK 'D' KUMBHAWADE PLATEAU, RATNAGIRI DISTRICT, MAHARASHTRA

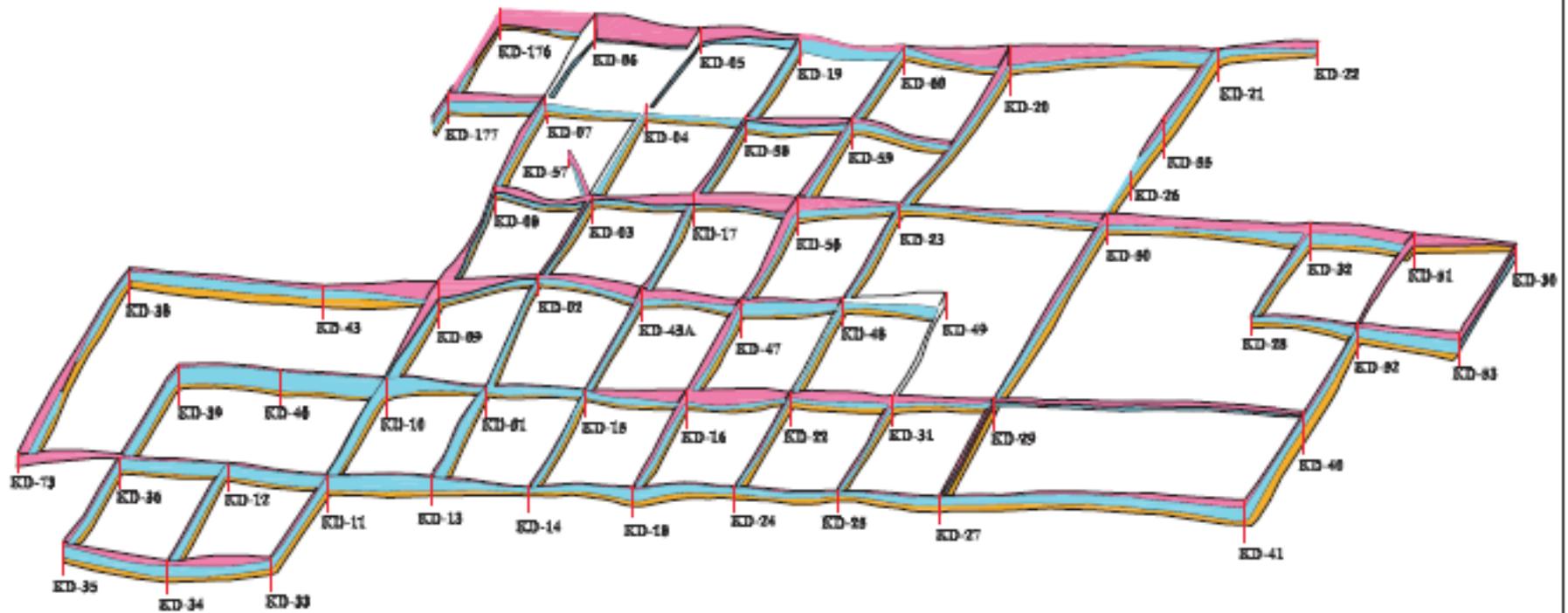
INDEX

| | | | |
|----|--------------------|----|---|
| L | LATERITE | MB | MEDIUM GRADE BAUXITE |
| AL | ALUMINOUS LATERITE | C | FERRUGINOUS CLAY WITH IRON PAN & PIECES OF LATERITE |
| LB | LOW GRADE BAUXITE | LC | LITHOMARGE CLAY |



GEOLOGICAL SURVEY OF INDIA

FENCE DIAGRAM SHOWING THE BAUXITE PROFILE IN KUMBHAWADE BLOCK 'A'
RAJAPUR TAHSIL, RATNAGIRI DISTRICT, MAHARASHTRA



INDEX

LATERITE



BAUXITE



LITHOMARGE CLAY



SCALE



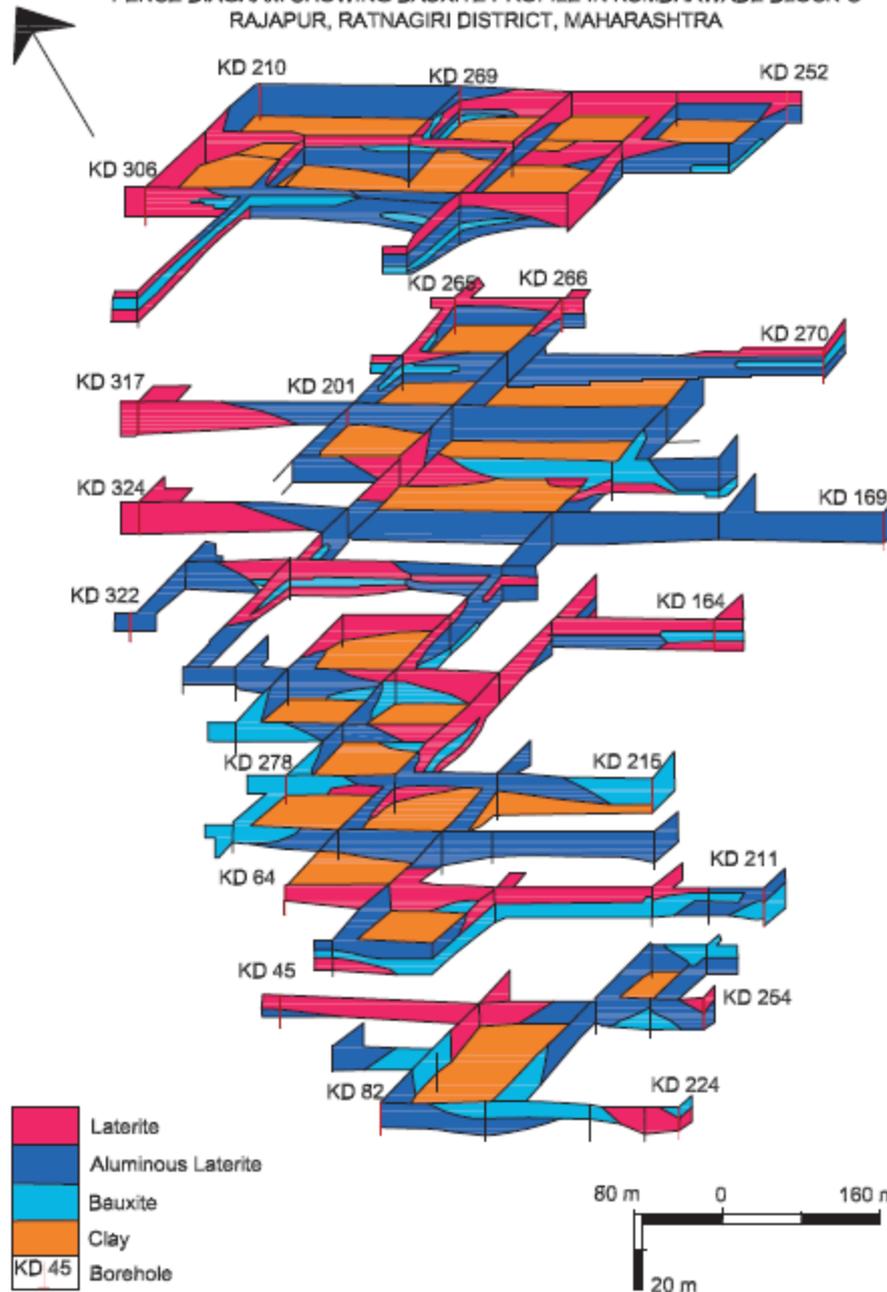
BY - S.K.BHATIA, Geologist(Sr)

DIGITIZED BY - S.G.MHATRE, JTA(DO)

D.O.No- GSI/OPN.MAH(W),PUNE/1269

F.S.:2002-03

FENCE DIAGRAM SHOWING BAUXITE PROFILE IN KUMBHAWADE BLOCK-C
RAJAPUR, RATNAGIRI DISTRICT, MAHARASHTRA



As per the UNFC field guidelines the exploration pattern for bauxite deposits of the **pockety nature of Konkan plateau**

Under G3 stage

- **Geological mapping (50000-to 5000 scale)**
- **Pitting/ trenching/ drilling depending on variability.**
- **Borehole spacing generally 100m to 200m.**
- **Petrographic & mineragraphic studies**

Under G2 stage

- **Geological mapping on 5000 to 1000 scale with triangulation stations/ bench marks and linking with topogrids.**
- **Pitting/ trenching and correlation of bands**
- **Drilling in 100m interval**
- **Petrographic studies.**

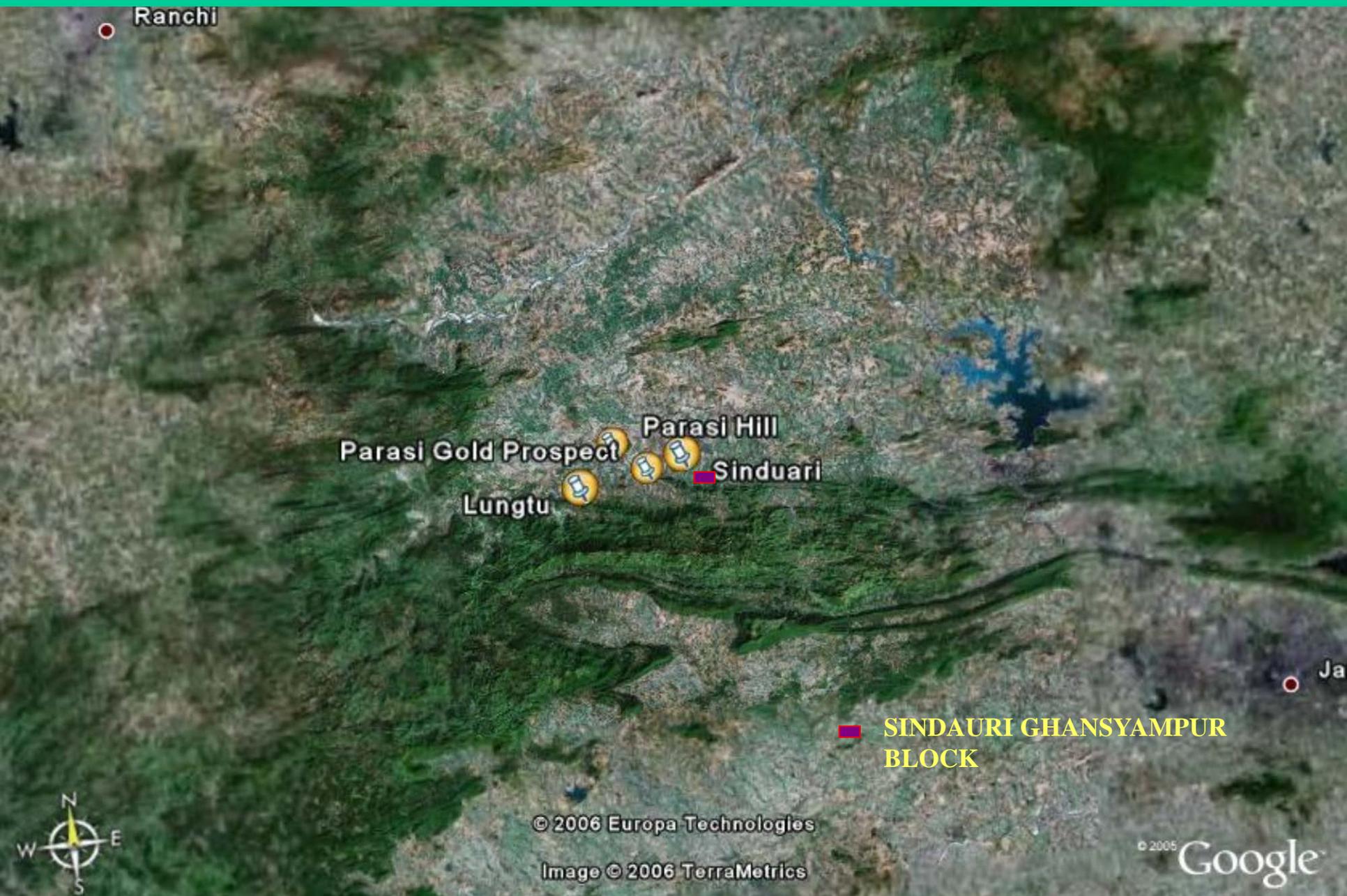
**Summarised Resource figures in million tonnes of Rajapur Plateau,
Ratnagiri District.**

| Block | Low Grade (40-45% Al ₂ O ₃) bauxite | Medium Grade (45- 50%Al ₂ O ₃) bauxite | High Grade (>50% Al ₂ O ₃) bauxite | Aluminous laterite (35- 40%Al ₂ O ₃) | Resource Category |
|------------------------------------|---|--|--|---|---|
| Kumbhawade block "A" | 0.566 | 0.31 | 0.47 | 1.48 | Probable or 332- Indicated mineral resources as per UNFC |
| Kumbhawade block "C" | 1.51 | 0.33 | 0.18 | 5.595 | Probable or 332-Indicated mineral resources as per UNFC |
| Kumbhawade Block "D" | 0.098 | 0.045 | 0.035 | 0.30 | Probable or 332-Indicated mineral resources as per UNFC |
| Total A+C+D | 2.174 | 0.685 | 0.685 | 7.375 | 332 as per UNFC |
| Ghodepaiwadi | 0.18 | 0.04 | -- | 0.45 | Probable or 332-Indicated mineral resources as per UNFC |
| Nanar | 1.176 | 0.748 | -- | 4.10 | Possible or 332-Inferred mineral resources as per UNFC |
| Humdara | 0.107 | 0.102 | -- | 0.87 | Probable or 332-Indicated mineral resources as per UNFC |
| Total Rajapur Resources | 3.637 | 1.575 | 0.685 | 12.795 | Probable + Possible or 332-Indicated mineral resources as per UNFC |

CASE STUDY. II

***GOLD MINERALISATION AT
PARASI IN LUNGTU- PARASI-
SINDAURI AREAS, RANCHI
DISTRICT, JHARKHAND.***

SATELLITE IMAGERY OF PARASI GOLD PROSPECT



Ranchi

Parasi Gold Prospect
Parasi Hill
Sinduari
Lungtu

**SINDAURI GHANSYAMPUR
BLOCK**

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Image © 2006 TerraMetrics

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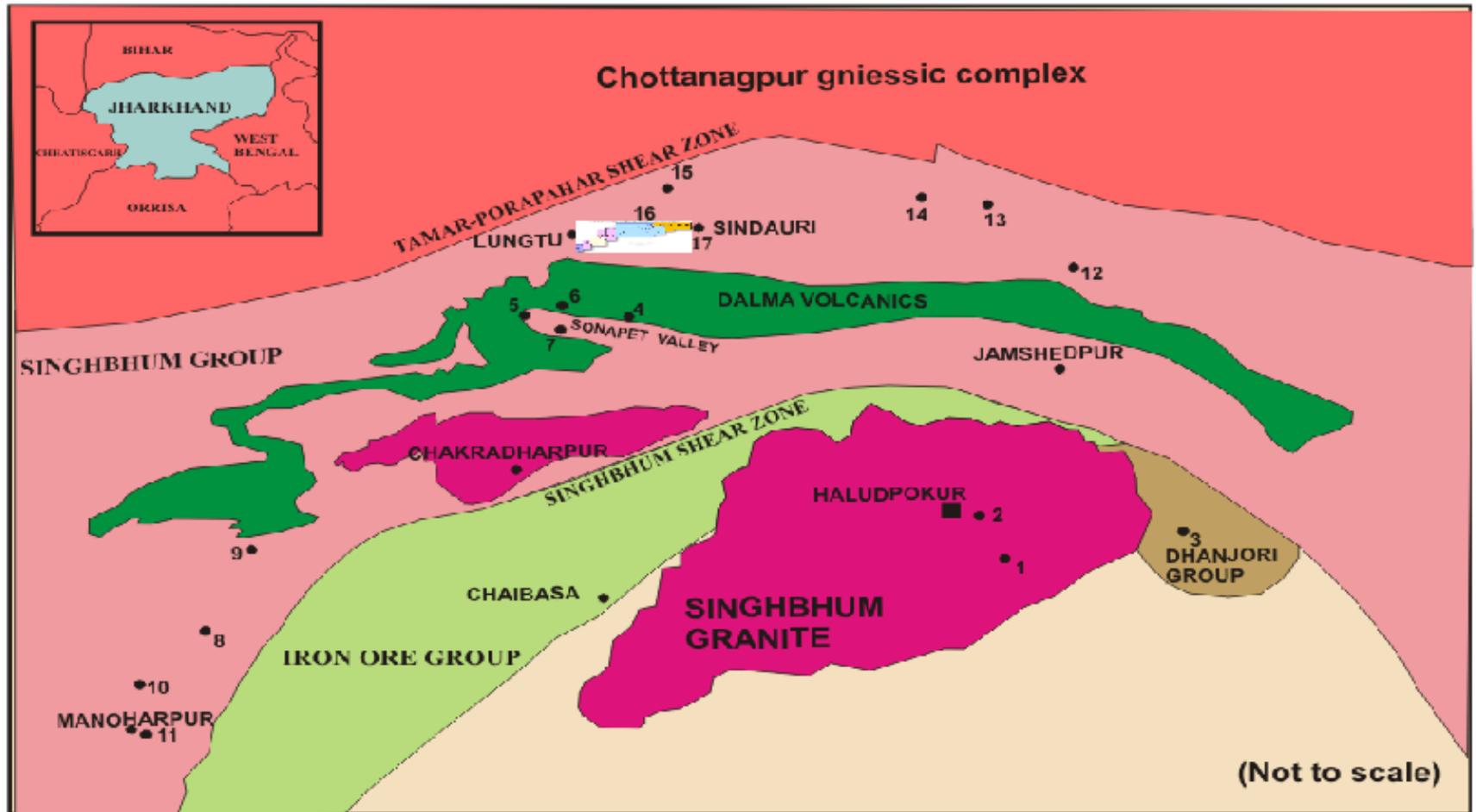


Pointer 22°59'18.35" N 85°44'31.98" E elev 842 ft

Streaming ||||| 100%

Eye alt 58.99 mi

Location map of gold occurrences in singhbhum greenstone-granite terrain, Jharkhand



1.Kundarkocha, 2. Porojharna, 3. Baruniya, 4.Chatuhasa, 5. Taramba, 6. Siadih, 7. Rugudih, 8. Ankua, 9. Sausal,10. Pahardia, 11. Rungikocha, 12. Lawa, 13. Mayasara, 14. Ichagarh, 15. Babaikundi, 16. Parasi 17. Sindauri

Soil/ Alluvium

Intrusives

Quartz vein & Quartz-carbonate veins

Metabasics

Ultramafics

Dalma Group

Acid tuff, acidic volcanic breccia and rhyolite

Tuffaceous phyllite with intercalated (schistose) quartzite/buff grey quartzite Carbon phyllite ± grey(carbonaceous) quartzite

-----Sheared contact-----

Dalbhum Group

Magnetite-quartz-biotite-sericite phyllite

Singbhum

Magnetite-biotite-quartz-sericite

Supergroup

Chaibasa Group

schist and intercalated ferruginous quartzite

Basement

(Singbhum granite?)

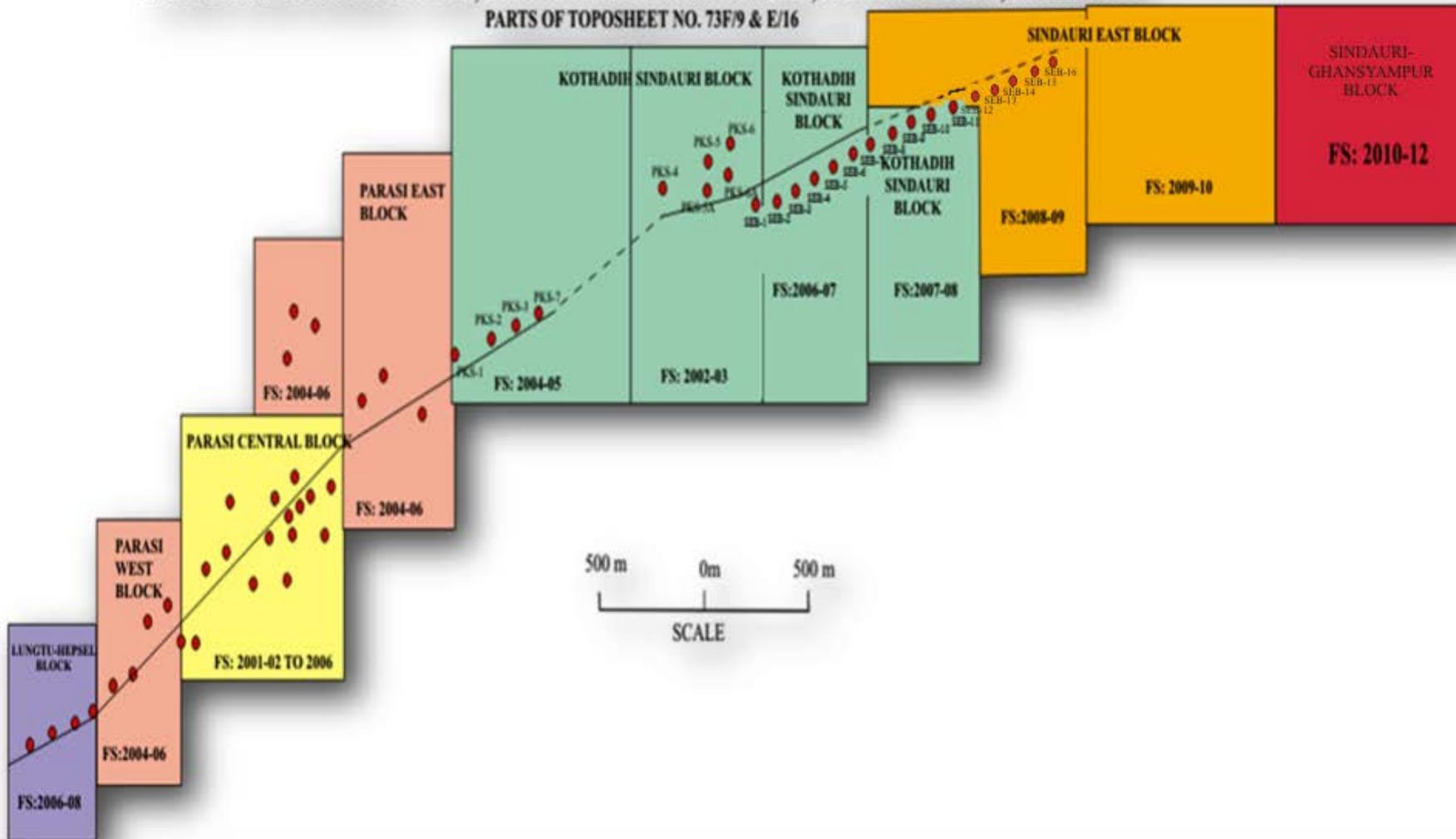
THE BACKGROUND STORY

- **Dunn (1924) cited some of the important gold occurrences in Manbhum and Singhbhum districts. Ziauddin and Narayanaswamy (1974) described gold occurrences in parts of Chhotanagpur.**
- **Gupta and Basu (1984) mapped the areas in and around Sonapet valley and brought out the stratigraphy, petrography and structural details.**
- **The blue quartz reef was mined for extraction of gold (Lawa Gold Mines) at Lawa. GSI carried out exploration for gold in Lawa area (D.Lahiri et. al., 1971).**

- Preliminary search for gold (P-I & PII stage) to the north of Sonapet valley was carried out in 1992-93.
- The geochemical samples analyses showed anomalous gold values such as 10.27ppm, 5.76ppm, 3.79ppm, 2.6ppm, 2.2ppm, 1.66ppm etc. This investigation also brought out a shear zone (120 m to 150 m in width and about 700 m in length near Parasi), having some positive bearing on gold mineralizations in the area.
- On the basis of these encouraging surface values of gold a successor programme for exploration under E-I stage was taken up in Parasi area during 2001-02.
- The corresponding subsurface results confirmed gold mineralizations at depths. Disseminated gold mineralisation has been found throughout the 200 m wide shear zone for over 1.5 km in strike length.



LAYOUT MAP OF PROJECT: GOLD, LUNGTU-PARASI-SINDAURI AREA, RANCHI DISTRICT, JHARKHAND
PARTS OF TOPOSHEET NO. 73F/9 & E/16



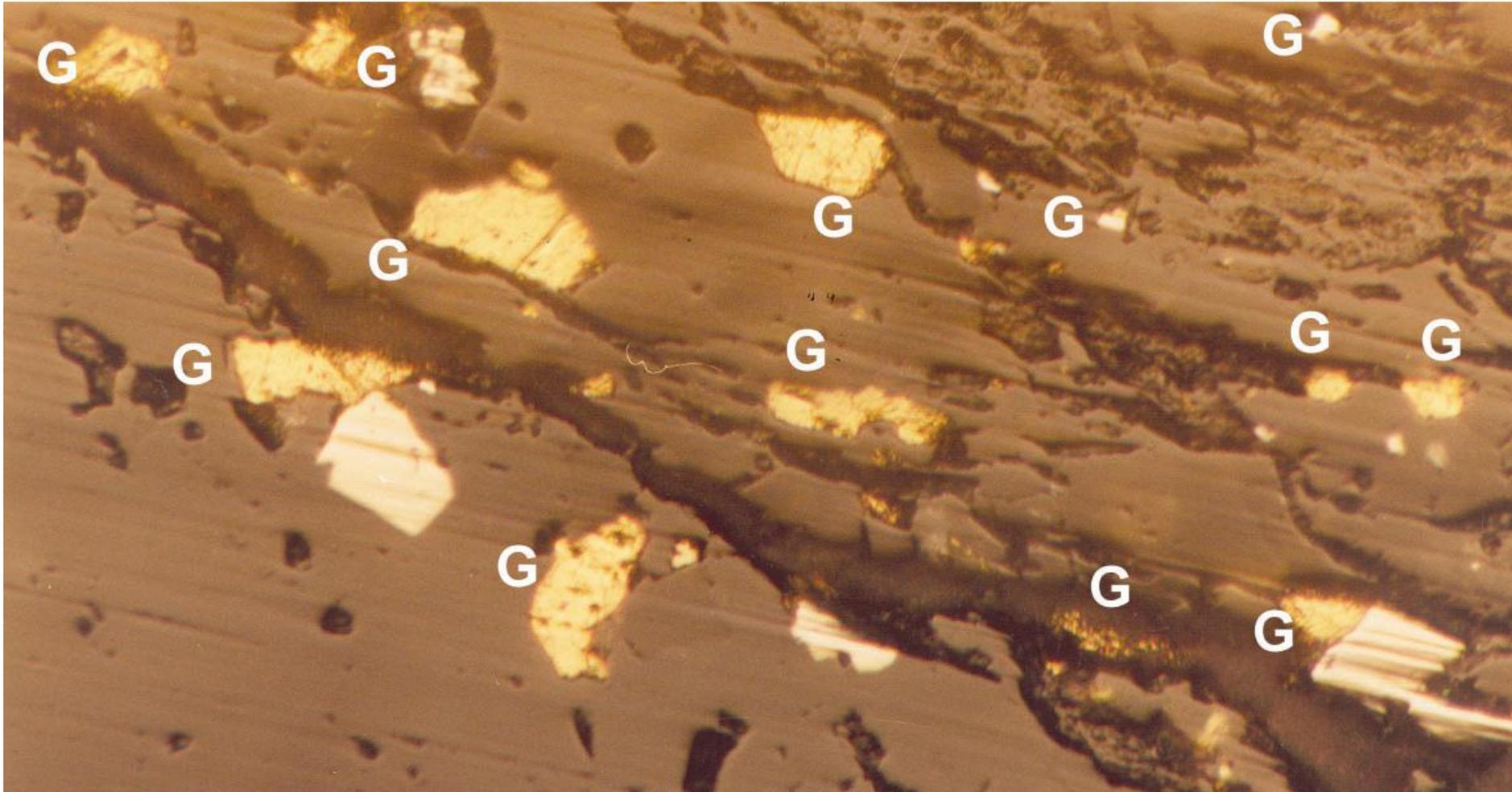
NATURE OF MINERALISATION

MINERALISATION Massive to disseminated, network of stringers, veinlets and veins forming stockworks.

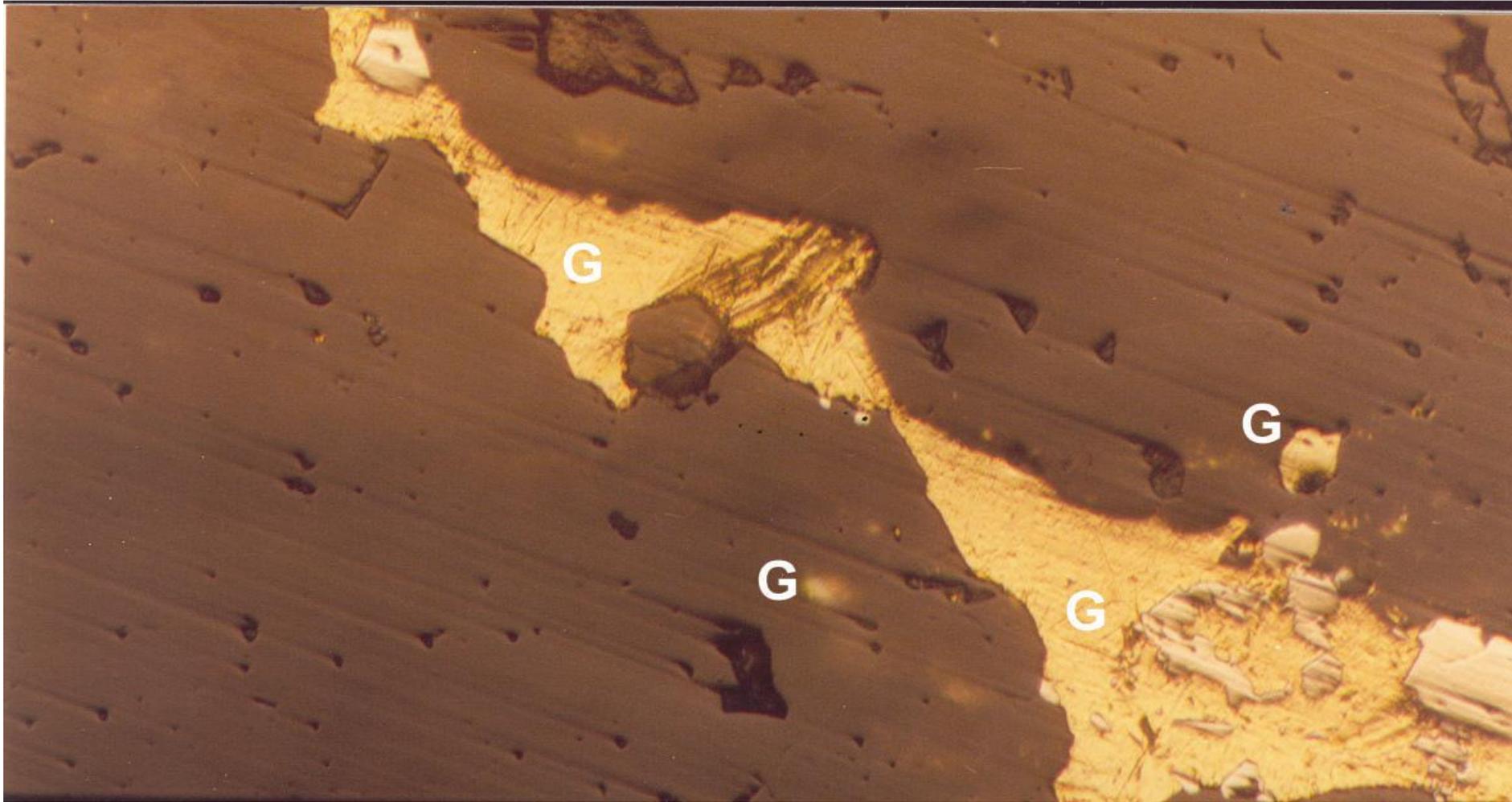
WALL ROCK ALTERATION Chloritisation, Silicification, Epidiotisation etc. Carbonatization,

ORE MINERALOGY Detailed ore microscopic study revealed following co-existing mineral phases
Arsenopyrite, Pyrite, Chalcopyrite, Pyrrhotite.

PHOTOMICROGRAPHS OF POLISHED SECTION (magnification: 100x)



PHOTOMICROGRAPHS OF POLISHED SECTION (magnification: 100x)



EXPLORATION PATTERN

- *Detailed mapping on 1000 scale*
- *Pitting /trenching at regular interval.*
- *Channel/groove sampling.*
- *Drilling at 50m interval at first level and 200m at second level .*
- *Core sampling*
- *Baseline environmental data generation*

Work quantum

| Work input | Quantum |
|--|-----------|
| Detailed mapping on 1:1000 scale | 1.5 Sq.km |
| P/T | 220 Cu.m |
| Groove Samples | 677 Nos |
| Drilling | 13 Nos |
| Core samples | 2191 Nos |
| Baseline environmental data generation | |

RESOURCE ESTIMATION

- The present estimate of the tonnage and grade of gold was carried out by General Exploration (G2).
- The Feasibility axis code remains at (F3) as only Geological Study was done of a prospect of intrinsic economic interest (E3). Therefore, this has been categorized as 332.
- Under this category interpolation was made from surface up to the borehole intersection of any particular mineralized zone.
- Under UNFC 333 (Prospecting category), the dip length has been extrapolated upto 120m from the first level borehole intersection. Extrapolation to such depths has already been proved by intersection in some boreholes.

| | | | | | | | | | |
|-------------|------------|--|--|------------|--|--|--|--|--|
| 60m | | | | 332 | | | | | |
| 120m | 333 | | | | | | | | |

Resources at Parasi under UNFC Format

| Cut off grade g/t | Resource (million tonnes) | Grade(g/t) | UNFC category |
|----------------------------------|---|-------------------|--------------------------|
| 0.5 | 1.191 | 1.26 | 332 |
| 1.0 | 0.544 | 2.44 | |
| 3.0 | 0.137 | 6.04 | |
| 0.5 | 1.190 | 1.24 | 333 |
| 1.0 | 0.484 | 2.51 | |
| 3.0 | 0.121 | 6.30 | |
| 0.5 | 2.381 | 1.25 | 332+333 |
| 1.0 | 1.028 | 2.52 | |
| 3.0 | 0.258 | 6.48 | |

Thanks

You can also contact me on
kskodoth@yahoo.com
Shashi_kodoth@rediffmail.com