

DETAILED INFORMATION
ON
GOLD ORES
IN
INDIA



GEOLOGICAL SURVEY OF INDIA
1994

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**DETAILED INFORMATION ON
GOLD ORES IN INDIA
(KARNATAKA AND ANDHRA PRADESH)**

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1.0 INTRODUCTION

Gold mining in South India is restricted to only three mines located in the States of Andhra Pradesh and Karnataka producing about 1.65 tonnes of gold per annum. There are 60 ancient/old workings for gold spread throughout the States of Karnataka and Andhra covering an area of 2.38 lakh sq.km. The greenstone - granite terrain has evolved over a period spanning from 3400 to 2500 M.Y. Out of the granite-greenstone area, the greenstones (volcano-sedimentary) known as "Dharwar schist belt" covers an area of about 40,000 sq.km. All the detailed exploration for gold involving geological, geochemical, geophysical studies followed up by drilling and exploratory mining has been mostly centered around the ancient/old workings with a view to re-evaluate the gold potential in these well known auriferous areas and also to pick up any of the extension of these areas for evaluation and exploitation.

This report has been compiled by Sarvasri N. Bhaumik, T.S.S. Murthy, Dr. A. Gupta and Mr. M.M. Mukherjee.

The data incorporated in this document have been compiled mostly from GSI Reports. Sources other than GSI have been indicated in the appropriate data sheets in the text.

1.1 Geological Setting :

Lithostratigraphically, the rock units in the States of Karnataka and Andhra Pradesh, as far as the Archaean Formations are concerned, have been grouped into three groups :

Dharwar	:	Chitradurga Group	>2,600 m.y.
Supergroup		Bababudan Group	

-----Unconformity-----

		Peninsular Gneissic Complex	
		Sargur Group	>3,000 m.y.

Most of the major occurrences of gold in Archaean are restricted to the age of 2.7 b.y. Hence the geological set up is ideal in Karnataka and Andhra Pradesh for gold mineralisation.

Sargur group of rocks which are +3,000 m.y. in age constitute high grade metamorphic schists comprising both metasediments, metavolcanics and metaultramafics occurring as enclaves of various dimensions within the migmatite country. The oldest age of the migmatite itself is between 3,000 and 3,200 m.y. Hence, the Sargur group of rocks are likely to be older than this age. Kempinkote, Gollarahalli, Yelwari and Vittalapura, Amble-Wollagiri and Bellibetta occurrences form a part of this schist belt.

The Bababudan group of rocks lying unconformably over the migmatite with a basal oligomict quartz pebble conglomerate is comparable in age to that of Rand (Africa) and Blind River conglomerate (USA). This conglomerate is feebly radioactive and carries gold to a maximum of 0.25 g/t. The areal extent and thickness of this conglomerate being very limited, no major gold deposit is likely to be expected from this formation. Other than this gold occurrence associated with the conglomerate, no major occurrence of gold is known from this group of volcano-sedimentary unit.

The Chitradurga Group of rocks constitutes a thick pile of volcano-sedimentary unit comprising meta-basalt, meta-andesite, meta-acid volcanics and tuffs comprising the volcanic unit and the meta-sedimentaries are represented by a thick pile of greywacke sequence and banded iron formation. The Gadag gold fields and the sulphide belt stretching from Honnemaradi to Yerahalli is hosted in this group of rocks. In addition, Ajjanahalli gold occurrence in the sulphidic banded iron formation and Bellara gold mines hosted in metabasalts also form a part of this group.

The above two groups i.e. the Bababudan group and the Chitradurga Group form the western segment of the Karnataka Craton, where the volcanics and sedimentaries are in equal proportion.

The above western segment is separated from the eastern group of schist belts by the linear Closepet granitic body. The eastern schist belts comprising the Kolar schist belt, Veligallu-Kadur-Gadawal schist belt, Hutti schist belt, Raichur schist belt, Mangalur schist belt and Ramagiri-Penakacherla-Hungund schist belt, differ from the western schist belts in their bulk lithology. These eastern schist belts are dominantly composed of (95%) volcanic rocks comprising metabasalts and its variants with minor acid volcanics. This eastern group of schist belts host

the two working mines for gold in Karnataka and one in Andhra Pradesh, which have produced nearly a thousand tonnes of the metal. Hence, in any scheme of exploration/exploitation, these schist belts get precedence over the western schist belts vis-a-vis gold mineralisation.

1.2 Gold Mineralisation :

Gold mineralisation in Karnataka and Andhra Pradesh is hosted in ultramafic rocks talc-tremolite schist (Nuggihalli schist belt), metabasalts, meta-andesites (Gadag, KGF, Veligallu, Hutti, Ramagiri etc.,) meta-acid volcanics (southern part of KGF and part of Hosur-Champion in Gadag), and in metasedimentaries like greywacke (Sangli-Mysore mine, Attikatti-Kabuliyatkatti) and in BIF (Ajjanahalli and Chinmulgund). The above description clearly brings out that the gold mineralisation is not restricted to any one lithological unit but occur in a wide variety of rock types. Minor occurrences of gold is noticed in granitoids also near its contact with the schist belt.

1.3 Structural Control :

The most dominant controlling factor for the mineralisation of gold is the structural control as exemplified by ductile/brittle shears, fold closures and contacts of lithounits sited adjacent to transition shear zones. The shear control for gold mineralisation is very evident in KGF, Hutti, Ramagiri and Veligallu areas. In the Ajjanahalli area, in addition to shear, antiformal hinze zones have played a dominant role in controlling the gold mineralisation. In the Chinmulgund area, mineralisation is at or near the contact of BIF with pyritic tuff.

1.4 Ore Zone :

The gold mineralised zone is identified by wall rock alteration exemplified by retrogression of minerals and influx of potash into the wall rock (chloritisation and sericitisation). In addition, mineralised zones are invariably associated with sulphide minerals like pyrite, pyrrhotite, chalcopyrite, galena and arsenopyrite. Carbonatisation is also present in several instances. Presence of antimony, bismuth and tungsten mineralisation is also indicative of Au mineralisation.

1.5 Current Scenario of exploitation and exploration :

Currently gold is won from the following underground operating mines of Karnataka and Andhra Pradesh of South India :

Name of the Mine	Names of lode and type of lode	Premining tonnage of ore (million tonnes)	Gold Grade g/t
KARNATAKA			
1. Hutti Gold Mines Limited, Raichur district (HGML)	Six lodes forming a mine block, gold-quartz-scheelite lode, ore partly free-milling and partly refractory i.e. mixed type. About 60% is native gold in free state, 40% included in sulphide.	10.02	5.54
2. Kolar Gold Fields, Kolar District. (BGML)	(a) Champion lode (free-milling type)	45	16
	(b) Oriental lode (sulphide refractory ore)	9.7	5
	(c) McTaggart's East lode	—	—
	(d) McTaggart's West lode	—	—
ANDHRA PRADESH			
3. Ramagiri, Om. Pratima-Gantalappa sector, Anantapur district, (BGML)	Yeppamana Main lode and Yeppamana lode (mostly free-milling type fine gold)	1.05	4.00
4. Chigargunta block, (South Kolar schist belt), Chittoor Dt. (BGML)	Three lodes over a cumulative length of 2.25 km (free-milling type)	4.19	4.00

HGML - Hutti Gold Mines Limited

BGML - Bharat Gold Mines Limited

PRODUCTION DATA AS ON 1989

Name of Mine	Gold in Kg.	Grade g/t	Depth	Remarks	Source
1. Hutti	900	5.0	700 m	Primary	
2. K.G.F., Ramagiri	800	3.5	1000 to 3000	Primary	Mining Journal, London 1990.
3. H.C.L.	110	—	—	By-product	
4. H.Z.L.	40	—	—	By-product	

In the existing mines of Kolar and Hutti, the total available reserve of gold metal is about 52 metric tonnes.

Production from the mines at Karnataka contributes chief primary production. In Yappamana mine, Ramagiri Gold Field, Andhra Pradesh, a 250 tpd mine-mill complex has been set up and production has just started. In Chigargunta block, Chittoor district, Andhra Pradesh, a 200 tpd mine has been constructed and is currently in operation. Both these gold mines could be developed following systematic exploration carried out by national agencies during the last two decades. Apart from these underground operating mines gold is also won as by-product from base metal mining by Hindustan Copper Ltd. (HCL) and Hindustan Zinc Ltd. (HZL). Geological Survey of India and Mineral Exploration Corporation Limited are the two national agencies which carry out preliminary and detailed exploration for gold respectively.

2.0 SCHIST BELT-WISE/BLOCK-WISE DESCRIPTION OF GOLD PROSPECTS

2.1 There are large number of gold prospects in Karnataka and Andhra Pradesh of which the data on the better explored blocks are presented in the following pages. The table below furnishes a list of selected schist belts of Karnataka and Andhra Pradesh and the prospective blocks therein. The status of exploration of each of the blocks is also indicated.

A. EASTERN GREENSTONE BELTS

Sl. No.	Name of the belt	Name of the blocks	Status of Completed	Exploration In Progress
1.	I. Hutti-Maski	A. Uti	Yes	—
		B. Uti Temple	—	Yes
		C. Tuppadhur	Yes	—
		D. Wandalli	Yes	—
		E. Chinchergi	Yes	—
		F. Kadoni	Yes	—
		G. Buddini	Yes	—
		H. Sanbal	Yes	—
2.	II. Ramagiri-Penakacherla-Hungund	A. Ramapuram	—	Yes
		B. Bhadrampalle	—	Yes
		C. Kottapalle	—	Yes
		D. Chinnabhavi	—	Yes
		E. Penakacherla-Kuderu	—	Yes
		F. Penukonda	—	Yes

Sl. No.	Name of the belt	Name of the blocks	Status of Completed	Exploration In Progress
3.	III. Kolar	A. Surapalle	Yes	—
		B. Chigargunta B1-IV, West	Yes	—
		C. Chigargunta North of B1-I	Yes	—
		D. Mallappakonda	Yes	—
		E. Old Bisanattam	Yes	—
		F. Kudithanapalle	—	Yes
B. WESTERN GREENSTONE BELTS				
4.	IV. Gadag	A. Hosur-Champion	Yes	—
		B. Mysore Mine	Yes	—
		C. Sangli	—	Yes
5.	V. Chitradurga	A. Ajjanahalli	Yes	—
		B. Bellara	Yes	—
		C. G.R. Halli	Yes	—
6.	IV. Shimoga	A. Chinmulgund	—	Yes
7.	VII. Nuggihalli	A. Kempinkote	Yes	—
TOTAL		28 Blocks	18	10

2.2 I. Hutti schist belt

Hutti schist belt is a part of the eastern group of the schist belts covering an area of 300 sq. km. and comprises dominantly of metabasalts and minor acid volcanics. About 5% of the area is covered by metasedimentaries represented by cordierite bearing gneiss, garnetiferous micaschist and carbon phyllite. The schist belt is bounded on all sides by granitoids which show intrusive relationship with the schist belt. The basement-cover relationship in the schist belt is obscured.

In the Hutti schist belt, old working/ancient workings for gold is known from 11 locations, viz., (1) Hutti, (2) Wandalli, (3) Chinchergi, (4) Buddini, (5) Kadoni, (6) Uti, (7) Maski-Sanbal, (8) Ballapur, (9) Udbal, (10) Tuppadhur and (11) Hira. Detailed investigations have been completed in the above blocks. From Uti block, a reserve of 0.8 million tonnes of +4 g/t gold has been established. In the Wandalli area, a reserve of 0.65 million tonnes of +2.5 g/t has been established. At present, the work is in progress in the Hira block, Tuppadhur block and Maski block. There is a vast area between Maski and southern end of the schist belt near Siddanur which is under a thick cover of soil which needs to be explored by indirect geochemical and geophysical surveys. The details of the work carried out in some of the prospective blocks in Hutti area are given in a tabular form detailing the quantum of work, the reserve proved and a brief geology.

A. Uti

1.
 - a) Belt Name : Hutti-Maski Schist Belt
 - b) Prospect/Deposit : Uti
 - c) Location : Northeast of Hutti
 - d) District : Raichur
 - e) Taluk : Devadurg
 - f) Village : Uti
 - g) Latitude : 16°22'00"
 - h) Longitude : 76°47'00"

2. Geological set up : The area consists of schistose and coarse grained amphibolite and meta-acid volcanics.

3. Control of mineralisation : The gold mineralisation is localised along narrow zones of high deformation characterised by silicification and carbonatisation of both mafic and acidic rock with narrow stringers/veinlets of quartz with sulphides.

4. Quantum of work done:
 - Detailed mapping : 2.75 sq km on 1:2000 scale
 - Trenching : 1978 cu.m
 - Drilling : 8828.85 m in 71 boreholes
 - Sampling : 2441 nos for Au assay, 1073 nos for Pedogeochemical

5. Dimension of ore body : 18 mineralised zones with a cumulative strike length of 3.32 km were delineated. The length of individual mineralised zones vary from 40 to 670 m with width ranging from 0.6 to 10 m.
6. Grade / Reserve : A total probable reserve of 0.884 million tonnes was estimated for 6 lodes upto a maximum depth of 130 m with grade varying from 2.04 to 18.98 g/t upto a depth of 100 m and average width from 1.00 to 7.32 m. In addition, a possible reserve of 0.143 mt with grade ranging from 2.73 to 3.80 g/t has been estimated.
7. Ore characteristics : Characterised by chloritisation and biotitisation with veins/veinlets of quartz, carbonate and dissemination of sulphides.
8. Recommendations : Development by MECL has indicated that the width of ore zone is +10 m with an average grade of +2.5 g/t, and reserves are of the order of 2.5 m.t. Open cast mining is possible upto 60 m. If projections of reserves are made to 300 m the reserves will be 7.5 m.t. accounting for a total metal of +15 tonnes.
9. Any other information : Laboratory scale study of bulk ore sample has been conducted by HGML.

B. Uti Temple

1.
 - a) Belt Name : Hutti-Maski Schist Belt
 - b) Prospect/Deposit : Uti Temple
 - c) Location : West of Uti Block
 - d) District : Raichur
 - e) Taluk : Devadurg
 - f) Village : Uti
 - g) Latitude : 16°22'00"
 - h) Longitude : 76°46'00"

2. Geological set up : Made up of metabasalt and coarse grained metagabbro with thin bands of ultramafic rock and carbon phyllite.

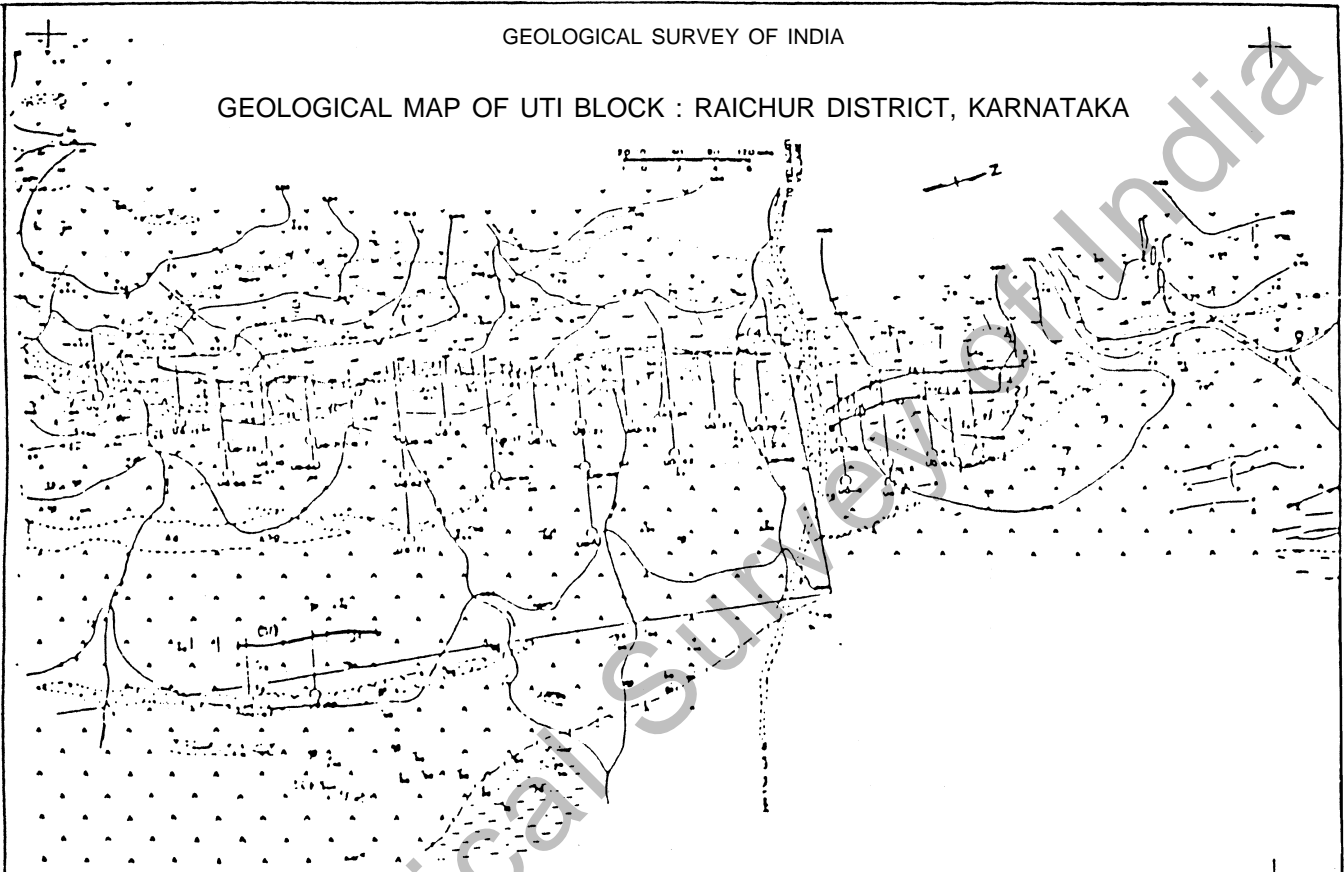
3. Control of mineralisation : Quartz vein within altered amphibolite or silicified zones within fine grained amphibolite carry the gold mineralisation with sulphides.

4. Quantum of work done :
 - Drilling : 328.20 m in 3 boreholes

5. Dimension of ore body : Three mineralised zones established over a strike length of 210 m, 60 m and 80 m with width of 2.00 m respectively.

GEOLOGICAL SURVEY OF INDIA

GEOLOGICAL MAP OF UTI BLOCK : RAICHUR DISTRICT, KARNATAKA



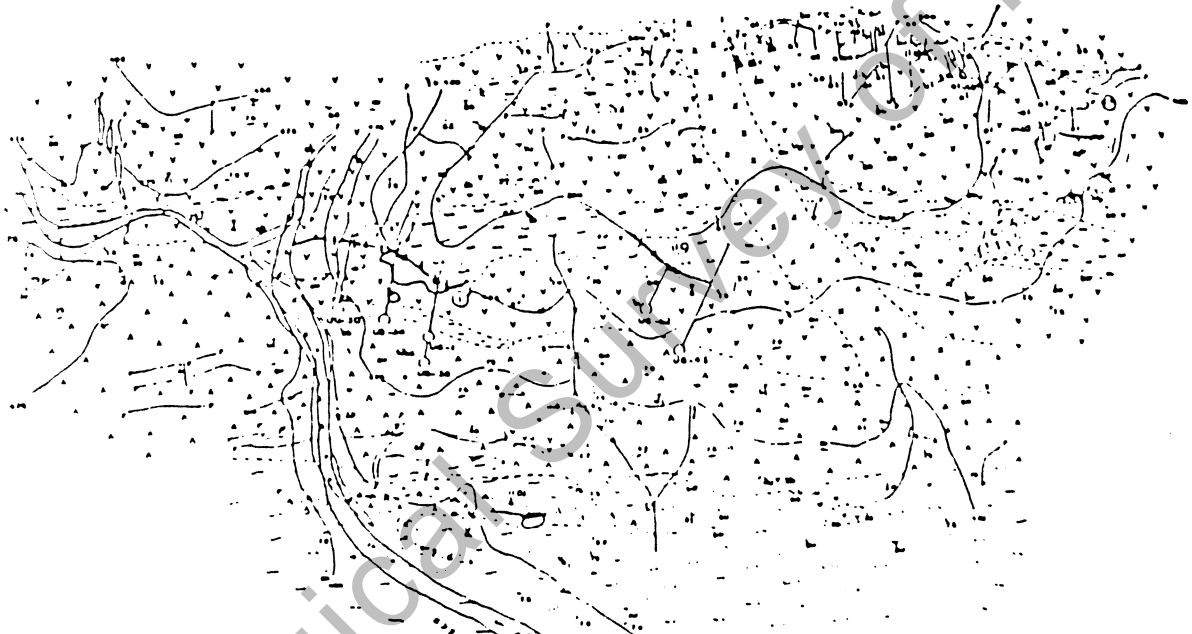
INDEX

- | | |
|---|--|
| [R1] Residual | --- Minor fold axis (1) |
| [D] Dolomite | - - - Minor fold axis (2) |
| [G] Gold bearing lode | - - Schistosity (1) |
| [Q] Quartz vein | - - - Crenulation cleavage (S) |
| [P] Pegmatite | - - - Mine hole (S) |
| [GR] Granite / Granite tongue | - - - Fault |
| [M] Meta ultramafic rock | - - - Area covered by geochemical sampling / Base line |
| [QMS] Quartz mica Schist with or without sericite & carbon phyllite | [A] Abandoned shaft |
| [AV] Acid volcanic rock with interbeds of metasediments | [OW] Old working / Dump |
| [AS] Acid volcanic rock with stretched, opaque quartz / Schistose acid volcanic | [OT] Old trench |
| [AVB] Acid volcanic with sillitic chat of biotite | [T] Trench |
| [E] Epidotized and sillitic amphibolite / Coarse grained amphibolite | [BH] Bare hole |
| [SA] Schistose amphibolite | [CT] Cart track |
| [C] Cordierite - sillimanite - Garnet gneiss. | [H] Hole |
| | [C12] Contour interval 12m |
| | [A] Triangulation station. |

GEOLOGICAL SURVEY OF INDIA

GEOLOGICAL MAP OF UTI BLOCK : RAICHUR DISTRICT, KARNATAKA

20 0 20 40 00m



INDEX

- | | | | |
|-----|--|---|--|
| 225 | Kansar | — | Minor fold axis (F ₁) |
| 226 | Quartzite | — | Minor fold axis (F ₂) |
| 227 | Gold bearing base | — | Schistosity (S ₁) |
| 228 | Quartz vein | — | Granulation cleavage (G ₂) |
| 229 | Pyroxenite | — | Kink band (K ₃) |
| 230 | Granite/Quartzite contact | — | Fault |
| 231 | Hard ultramafic rock | — | Area covered by geochemical sampling / Dose line |
| 232 | Quartzite meta-terrest with or without chlorite and carbon schistite | — | Abandoned shaft |
| 233 | Acid volcanic rock with interbands of metasediments | — | Old working / Dump |
| 234 | Acid volcanic rock with stretched opalescent quartz / fine glass acid volcanic / acid volcanic with siliceous clots of biotite | — | Old trench |
| 235 | Light green and crystalline amphibolite / coarse grained amphibolite | — | Trench |
| 236 | Spineliferous amphibolite | — | Bore hole |
| 237 | Chlorite - sillimanite - Garnet gneiss | — | Cart track |
| | | — | Well |
| | | — | Contour interval 12m |
| | | — | Triangulation station |

6. Grade / Reserve : Lode-I has a grade of 1.92 g/t over 1.0 m, 6.87 g/t over 4.44 m and 1.0 g/t over 0.23 m in 3 boreholes drilled.
7. Ore characteristics : Same as Uti area.
8. Recommendations : This prospect being very near Uti, it could supplement Uti resources.

Geological Survey of India

C. Tuppadhur

1.
 - a) Belt Name : Hutti-Maski Schist Belt
 - b) Prospect/Deposit : Tuppadhur
 - c) Location : North of Buddini Block
 - d) District : Raichur
 - e) Taluk : Manvi
 - f) Village : Tuppadhur
 - g) Latitude : 16°04'00"
 - h) Longitude : 76°39'00"

2. Geological set up : The area is made up of pillowed metabasalt, chlorite schist and highly carbonated chlorite schist with quartz-ankerite veins.

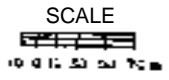
3. Control of mineralisation : Mineralisation is in quartz veins in chlorite schist (altered metabasalt) and quartz-ankerite veins in carbonated chlorite schist.

4. Quantum of work done :












Detailed mapping	: 2.95 sq km
Trenching	: 4357.50 cu m
Drilling	: 4187.00 m

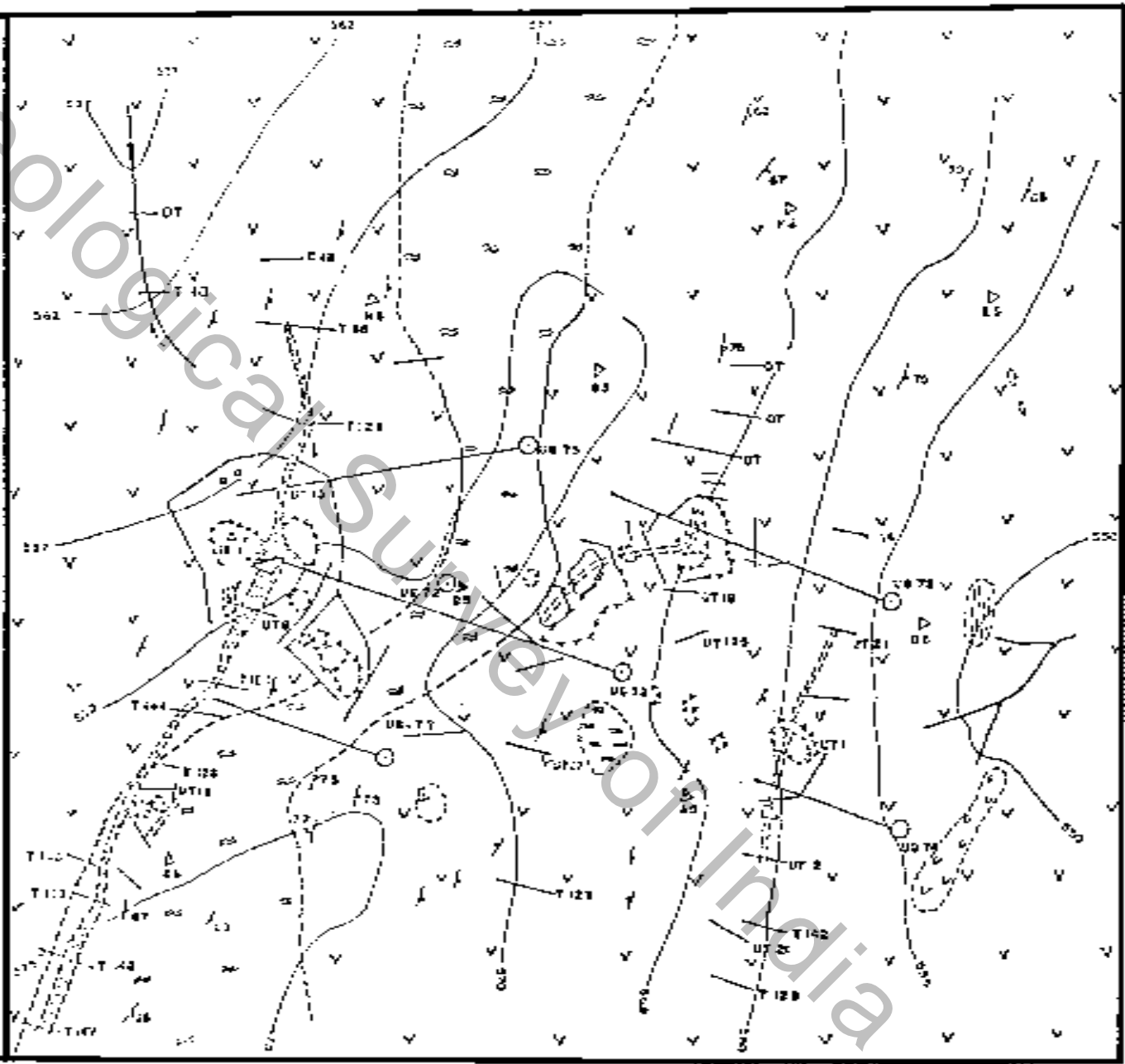
5. Dimension of ore body : 5 zones were established over a strike length of 1605 m. by trenching.

GEOLOGICAL MAP OF
UTI TEMPLE BLOCK



INDEX

-  Gold-bearing lode
-  Quartz vein
-  Coarse-grained amphibolite
-  Fine-grained amphibolite
-  Ultramafic rock
-  Carbon phyllite
-  Schistosity
-  Old trench / ASI Trench
-  Old working / Dump
-  Kufa
-  Telecommunication station



6. Grade / Reserve : A probable reserve of 0.089 million tonnes was estimated for Lode-I over strike length of 375 m and down to a depth of about 100 m with an average grade of 3.95 g/t with width ranging from 1.0 to 1.33 m.
7. Ore characteristics : Native gold in quartz vein with carbonate.
8. Recommendations : Ore mineralogy being simple. This prospect could be mined as a satellite to the main Hutti Mine.

D. Wandalli

1.

- a) Belt Name : Hutti-Maski Schist Belt
- b) Prospect/Deposit : Wandalli
- c) Location : East of Hutti Mine
- d) District : Raichur
- e) Taluk : Devadurg
- f) Village : Wandalli
- g) Latitude : 16°13'45"
- h) Longitude : 76°44'30"

2.

Geological set up : The rock types met with are massive, schistose and coarse grained amphibolite, acid volcanics, carbon phyllite and veins and lenses of granodiorite and quartz. The acid volcanics are represented by its variants like porphyritic and tuffaceous types.

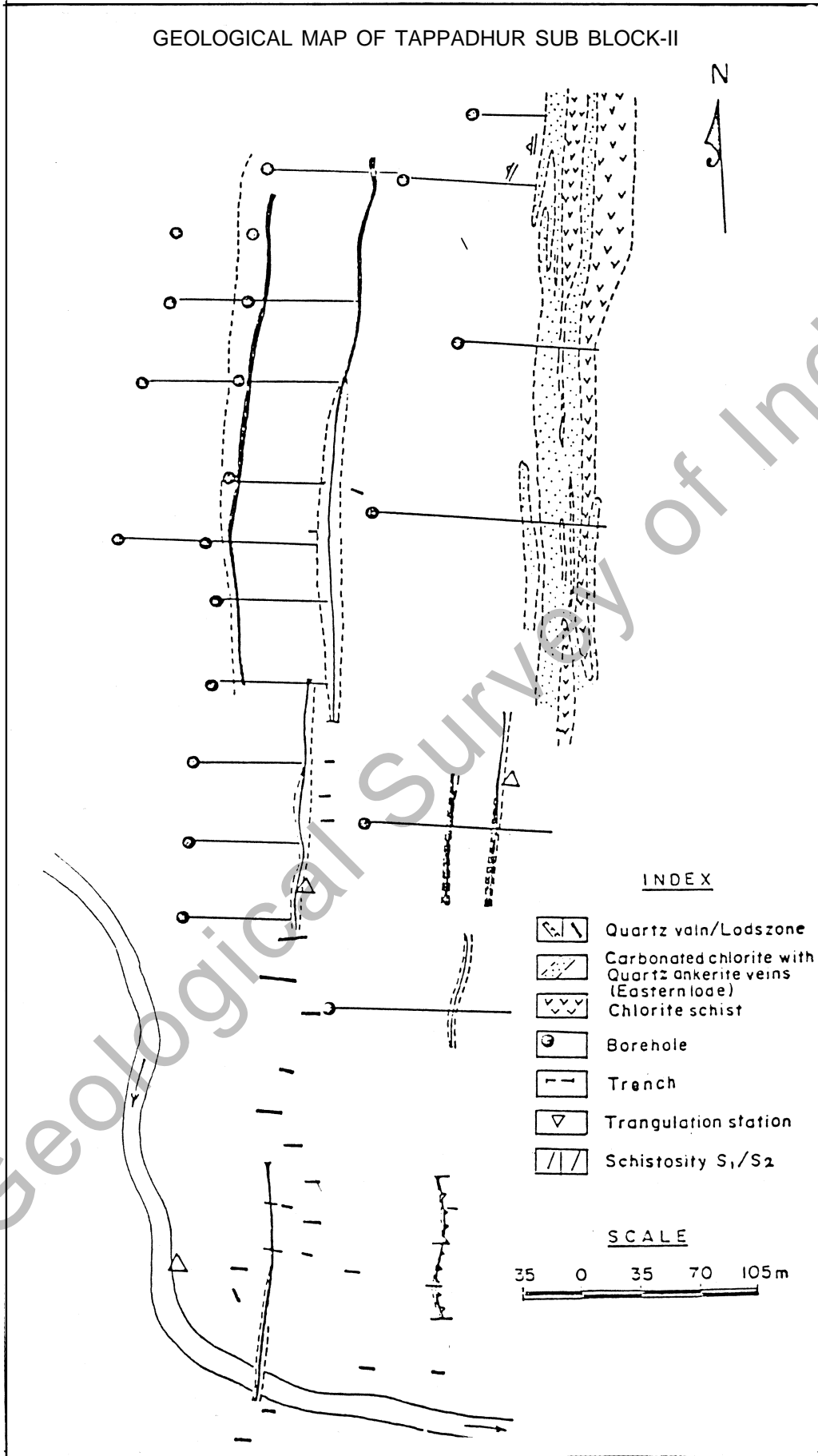
3.

Control of mineralisation : Shear controlled mineralisation which is late F_1 . Mineralised zone was affected by F_2 and F_3 deformation.

4. Quantum of work done :

- Detailed mapping : 2.5 sq km on 1:2000 scale
- Trenching : 3904 cu. m.
- Drilling : 12,857.15 m. in 89 boreholes
- Sampling : 4835 nos (Core & Trench)
1487 nos (Geochemical)

GEOLOGICAL MAP OF TAPPADHUR SUB BLOCK-II



5. Dimension of ore body : Length of ore shoot varies from 50 to 150 m. Depth continuity established upto 200 m and width varies from 1.00 m to 2.00 m.
6. Grade / Reserve : 0.65 million tonnes with 2.75 to 7.56 g/t over width of 2 m.
7. Ore characteristics : As at Column 3.
8. Recommendations : This area has ancient mines which have been worked down to 600 feet. This could be developed as a small scale mine.
9. Any other information : MECL carried out 600 m of underground development and 650 m of underground drilling. A reserve of 0.37 million tonnes with 2.77 g/t of gold upto 100 m depth was established.

E. Chinchergi

1.
 - a) Belt Name : Hutti-Maski Schist Belt
 - b) Prospect/Deposit : Chinchergi
 - c) Location : East of Wandalli
 - d) District : Raichur
 - e) Taluk : Manvi
 - f) Village : Chinchergi
 - g) Latitude : 16°09'45"
 - h) Longitude : 76°47'45"

2. Geological set up : Similar to Wandalli Block.

3. Control of mineralisation : Later stage of (F₁) deformation and shearing controlled the mineralisation. Mineralised zones underwent F₂ and F₃ deformation.

4. Quantum of work done :
 - Detailed mapping : 1.75 sq km on 1:2000 scale
 - Trenching : 4064 cu m
 - Drilling : 5400.85 m in 42 boreholes
 - Sampling : 2070 nos

5. Dimension of ore body : Length of 3 mineralised zones: 114 m in 2 sections, 50 m and 101 m with widths varying from 1.0 to 1.31 m upto a depth of 100 m.

6. Grade / Reserve : Total reserve of 3 mineralised lodes is 58,191 tonnes with 1.00 to 1.31 m width and grade range of 4.71 g/t to 11.46 g/t.
7. Ore characteristics : Mineralisation is characterised by chlorite-biotite schist, biotite-chlorite schist and veinlets of quartz and carbonate and dissemination/stringers of sulphides.
8. Recommendations : The ore is of very high grade but of short strike length.

Geological Survey of India

F. Kadoni

1.
 - a) Belt Name : Hutti-Maski Schist Belt
 - b) Prospect/Deposit : Kadoni
 - c) Location : Kodani
 - d) District : Raichur
 - e) Taluk : Lingsugur
 - f) Village : Kodani
 - g) Latitude : 16°14'20"
 - h) Longitude : 76°41'40"

2. Geological set up : The area is mainly composed of metabasalts.

3. Control of mineralisation : The auriferous zones in the area are in sheared chlorite schist, chlorite-biotite schist, with veins of quartz and carbonate and disseminations of pyrite and chalcopyrite.

4. Quantum of work done :
 - Detailed mapping : 0.05 sq km on 1:2000 scale
 - Drilling : 1747.45 m in 16 boreholes
 - Sampling : 438 nos (Core)

5. Dimension of ore body : There are 3 mineralised zones of which the southern most is about 360 m in length, the central lode is 300 m in length and the northern

lode is about 100 m in length with an average width of 1.20 m.

6. Grade / Reserve : Reserve of 0.064 million tonnes with 1.20 g/t to 8.7 g/t over a width of 1.20 m. has been established.
7. Ore characteristics : The lodes are located in sheared chlorite-actinolite-biotite schist with quartz-carbonate veins and with sulphides.
8. Recommendations : A very small prospect.

Geological Survey of India

G. Buddini

1.

- a) Belt Name : Hutti-Maski Schist Belt
 b) Prospect/Deposit : Buddini
 c) Location : South of Tuppadhur
 d) District : Raichur
 e) Taluk : Manvi
 f) Village : Buddini
 g) Latitude : 16°11'34"
 h) Longitude : 76°48'20"

2. Geological set up : The main rock types of the area are the variants of metabasalts with quartz-carbonate veins containing auriferous zones along the shear zones. Sulphides include pyrite-chalcopyrite and arsenopyrite.

3. Control of mineralisation : Gold mineralisation is confined to highly sheared zones represented by chlorite schist. The ore zones are impregnated with stringers / veins and lenses of quartz with ankerite.

4. Quantum of work done :

- Detailed mapping : 1.5 sq km on 1:1000 scale
 Drilling : 2361.15 m in 27 boreholes
 Sampling : 645 nos

5. Dimension of ore body : About 7 parallel to subparallel and merging zones of mineralisation were traced of which only 3 namely Main, Mopla and Western lodes were found to carry major bodies of quartz and a large number of ancient / old workings.
- Only Mopla lode was found to contain ore of 5-6 g/t over a width of 1 m over a strike length of 200 m and upto a depth of 100 m. during initial test drilling.
6. Grade / Reserve : No reserve or grade has been estimated.
7. Ore characteristics : As a Column 3.
8. Recommendations : MECL has completed detailed exploration in this block developing 3 levels on the lode. Research is in progress at I.I.Sc., Bangalore to use sulphur eating bacteria for liberation of gold.
9. Any other information : 3-level mine development and drilling by MECL helped in revising the reserve. A reserve of 0.21 million tonnes of ore over 225 m. length on Mopla lode with an average grade 2.16 g/t of gold upto 200 m depth, was established.

H. Sanbal

1.
 - a) Belt Name : Hutti-Maski Schist Belt
 - b) Prospect/Deposit : Sanbal
 - c) Location : S.E. of Buddini block
 - d) District : Raichur
 - e) Taluk : Lingsugur
 - f) Village : Sanbal
 - g) Latitude : 15°58'00"
 - h) Longitude : 76°44'00"

2. Geological set up : The main rock types are chlorite-actinolite schist and quartz-sericite-schist traversed by gabbro dykes.

3. Control of mineralisation : The mineralisation is in the form of quartz veins with specks of sulphides.

4. Quantum of work done :
 - Detailed mapping : 0.36 sq km on 1:2000 scale
 - Pitting/Trenching : 3750 cu.m
 - Drilling : 1884.50 m
 - Sampling : 467 Nos.

5. Dimension of ore body : A total of 7 mineralised zones over a cumulative strike length of 935 m were traced by trenching.

6. Grade / Reserve : Lode-I, having a strike length of 75 m with gold values ranging from 23 to 305 g/t over a width of 0.3 to 0.75 m. was found significant.
7. Ore characteristics : Free-milling type ore.
8. Recommendations : Ore occurs only in rich shoots and is structurally complex. Possibility of obtaining high grade ores in localised pockets is apparent.

II. Ramagiri-Penakacherla-Hungund belt

This is the largest of the Eastern Greenstones extending for over 350 km in length with an average width of 2 km. This belt in the north is ultimately lost under the cover of Proterozoic rocks (Kaladgi basin) and Deccan Trap. In the south, it peters but into small enclaves near Gudibanda in Karnataka. The broad regional stratigraphy of the belt is presented below :

Mudenur Formation	Pyroclastic rocks, quartzite and local conglomerate. Graywackes with BIF, limestone and dolomite, metabasalts and felsic volcanics, local conglomerate.
Ilkal Formation	Metabasalt acid volcanics and BIF.
Lepakshi Formation	Ultramafics, amphibolites, quartzites, calcsilicates, phyllites and BIF.

The upper sedimentary units are well developed in Hungund and Sandur belts as well as northern part of Penakacherla belt. In all the remaining belts, volcanics and chemical sediments (mainly chert and BIF) dominate. Platformal sequence occurs as migmatized enclaves and screens in the western part of Ramagiri and Kolar (Sakarsananalli 'series') belts. This feature suggests that the western margin was probably resting on or close to the sialic continent (similar to the Western Greenstones) but is now intruded and migmatized, whereas the eastern contacts are invariably tectonic and intrusive.

The main lithologies are bimodal basalt-rhyolite suites, with basaltic rocks forming the bulk. There are some high-mg basalts and ultramafics (komatiite and intrusive peridotites) occurring at lower stratigraphic levels. The upper basaltic to rhyolitic rocks are reported to show calc-alkaline trends. Geochemical studies of the volcanic rocks show similarity with oceanic island arcs.

Gold mineralisation in Ramagiri area is known from the turn of the century, extending for over 15 km from Chinnabhavi to Jibutil. Gold occurs in sulphide-

bearing quartz veins emplaced along narrow shear zones in altered metabasalts, which are affected by extensive carbonatisation, chloritisation and sericitisation. Sizeable gold deposits of high tenor have not so far been located despite extensive exploration.

Geological Survey of India

A. Ramapuram Prospect

1. LOCATION :

Belt name	:	Ramagiri-Penakacherla-Hungund
Prospect	:	Ramapuram
Location	:	400 m NE of Ramapuram village
District	:	Anantapur
Mandal	:	Vajrakarur
Village	:	Ramapuram
Toposheet	:	57F/5
Latitude	:	14°53'30"N
Longitude	:	72°22'00"E
Ref. Point	:	Ramapuram Temple Lat. 14°53'30" Long. 72°22'00"
R. L. Surface	:	Max. 482m. Min. 380m. Av. 430m.

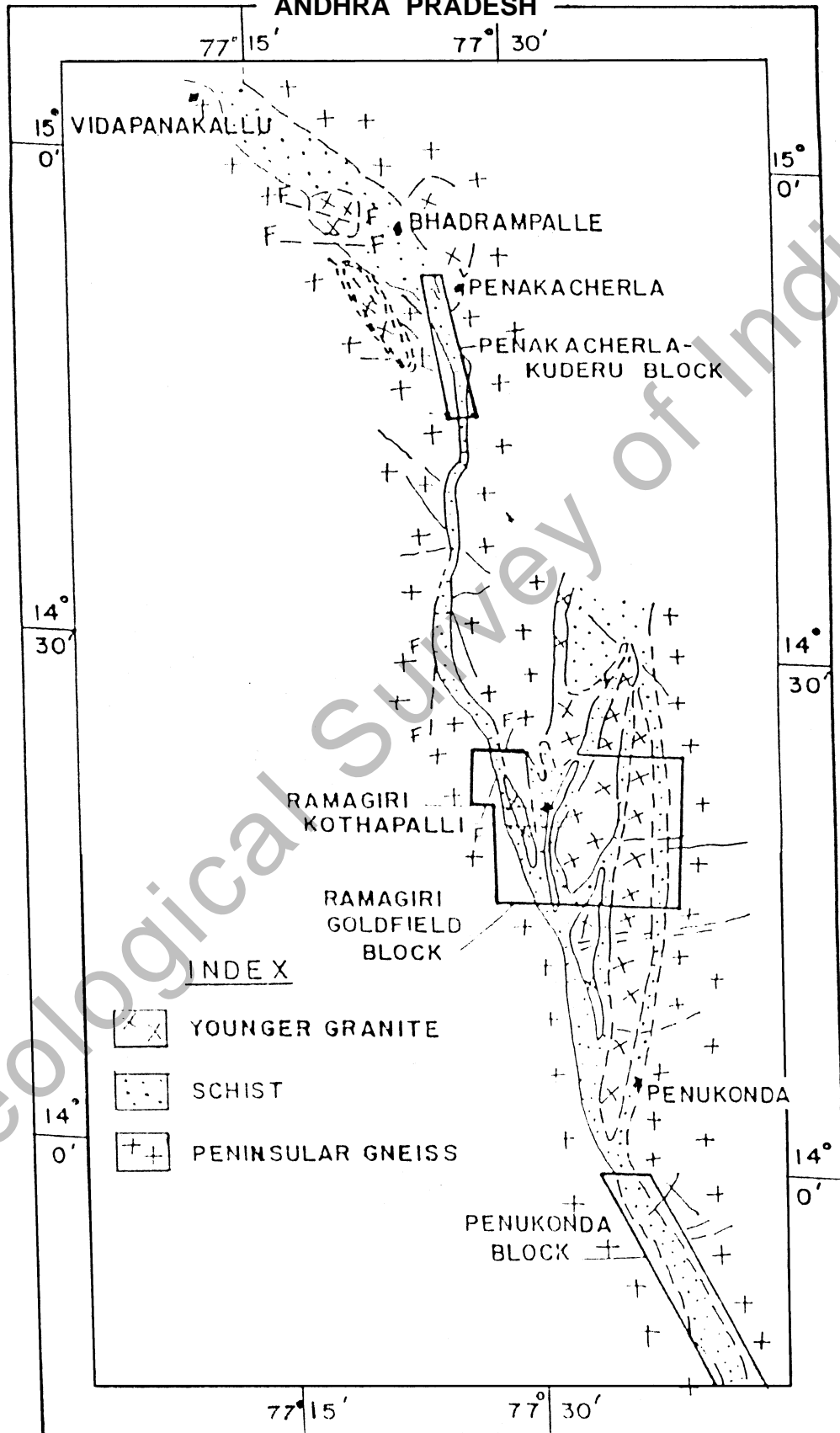
2. GENERAL GEOLOGICAL SET UP :

Ramapuram block mainly constitutes of metabasalt with a bands of chlorite, sericite, carbonaceous and actinolite schist, intruded by biotite granite, younger meta-gabbro and dolerite dykes and quartz veins.

Here the schist belt shows N-S to NNW-SSE trend flanked on either side by migmatites and gneisses. (In Ramapuram area, the schist belt takes NNW-SSE trend due to refolding).

GEOLOGICAL MAP OF RAMAGIRI - PENAKACHERLA SCHIST BELT, ANANTAPUR DIST.

ANDHRA PRADESH



3. CONTROLS OF MINERALISATION :

Gold mineralisation in Ramapuram block is found mainly in the quartz stringers, veins and veinlets associated with sulphides within the quartz reef emplaced in chlorite-carbonaceous schist. The mineralisation appears to be structurally controlled along N60°W-S60°E trending synclinal axis of macroscopic F_3 fold. Though gold mineralisation is found in almost all the rock units, there is enrichment in the quartz-sulphide phase within chlorite-carbonaceous schist.

4. TYPE OF EXPLORATION AND PHYSICAL QUANTUM OF WORK :

As at Bhadrampalli in Ramapuram block, there was ancient mining activity indicated by a number of old workings, mine dumps, pounding marks, etc. North Anantapur Gold Mines Ltd., a subsidiary of John Taylor and Sons from 1922 to 1927 developed underground mining along the modern lines by way of shafts, adits, etc.

Geological Survey of India carried out systematic geological mapping on 1:50,000 scale first and subsequently large scale mapping on 1:25,000 scale. In view of the potentiality of the area, detailed exploration has been taken up by plane table geological mapping, trenching, channel sampling followed by drilling investigation. The total quantum of the work done in detailed exploration is given below :

a)	Detailed geological mapping on 1:1,000 scale (sq.km)	0.30
b)	Trenching (cu.m)	60
c)	Drilling (m) (12 boreholes)	1,214.90
d)	Samples (Nos)	
	i) Drill core (Nos)	475
	ii) Trench	30

5. DIMENSIONS OF THE ORE BODY :

The total geometry, the size, shape and dimensions of the ore body is yet to be established. With the limited data available, mainly four auriferous zones of

mineralisation could be delineated. The first main lode (ML lode) is about 120 m. long with an average width of 1.50 m investigated upto a depth of 70 m. The second lode (W1) is 72 m long, 1.56 m wide explored upto 65 m vertical depth. The third lode (W3) has been delineated with 87 m length, 1.33 m average width and 35 m. depth. The strike length of the fourth lode (W2) is 67 m with an average width of 1.29 m and investigated to a depth of 34 m.k. 67 m, with an average width of 1.29 m and investigated to a depth of 34 m.

6. GRADEWISE RESULTS :

The overall grade of the deposit is yet to be established as the investigation is in progress. However with the available data, the tentative average grades of the auriferous zones and resources arrived at are given below :

Auriferous zone	Average Grade g/t	Resources (ore in tonnes)
1. Main Zone	11.39	30,714
2. W1 Zone	3.78	19,373
3. W2 Zone	1.28	14,706
4. W3 Zone	2.63	10.074

7. ORE CHARACTERISTICS :

Gold occurs mainly in native form as fine dust, disseminations and also as fine inclusions within arsenopyrite. The chief gangue minerals are quartz, carbonates, pyrite and arsenopyrite with minor chalcopyrite and pyrrhotite.

In thin section, the auriferous grey quartz shows shearing, granulation, development of crude mortar texture, undulose extinction and stretching.

8. RECOMMENDATION IF ANY FOR FURTHER WORK :

In Ramapuram block as there was extensive mine openings in the form of adits, and shafts this may need reclamation and study. The northern and southern extensions of the mineralisation could be investigated in the concealed soil cover areas.

B. Bhadrampalli

1. LOCATION :

- a) Belt Name : Ramagiri-Penakacherla-Hungund
- b) Prospect : Bhadrampalli
- c) Location : About 58 km NW of Anantapur
- d) District : Anantapur
- e) Mandal : Vajrakarur
- f) Village : 4.5 km SE of Venkkatampalli village
- g) Toposheet : 57F/5
- h) Latitude : 14°53'30" to 14°54'30"
- i) Longitude : 77°24'30" to 77°24'45"
- j) Ref. Point : Venkatampalli village Lat. 14°55'55"
Long. 77°22'20"

2. GENERAL GEOLOGICAL SET UP :

The area comprises of an interlayered "Greenstone" sequence of pillowed and non-pillowed metabasalts, meta-andesite, chlorite-sericite schists, phyllites, carbonaceous schists, banded haematite-grunerite chert and quartzites intruded and emplaced by syn-to post-tectonic quartz, ankerite veins, aplite, pegmatite and basic dykes/sills of doleritic to gabbroic composition. The rocks are folded into an overturned synform striking NNW-SSE with different lithounits dipping steeply towards ESE. The chlorite sericite schist with quartz veins and stringers trending along NNW-SSE synformal axis host the gold mineralisation. The orebody shows northerly 45° pitch. The overall grade of metamorphism of the rocks is that of greenschist facies.

3. CONTROLS OF MINERALISATION :

Auriferous quartz, quartz-ankerite veins, ranging in which from less than 1 cm to as much as 55 cm - are localised in bands of fissile chlorite-sericite schist confined to narrow zone along the synformal axis of the fold trending NNW-SSE plunging 45° towards north. Sulphide mineralisation associated with gold occurs as stringers in ankerite and sporadically in quartz veins aligned parallel or sub-parallel to schistosity. Gold mineralisation is mostly found associated with sulphides-mainly arsenopyrite and pyrite.

4. TYPE OF EXPLORATION AND PHYSICAL QUANTUM OF WORK :

a)	Detailed mapping on 1:1,000 scale (sq. km)	0.74
b)	Pitting/Trenching (cu m)	1,042
c)	Drilling-23 boreholes (m)	2,562.22
d)	Sampling (nos)	
	i) Trench	204
	ii) Core	939

During 1984-85, mapping on 1:20,000 scale (using tape-compass) in addition to about 1,015 cu.m of trenching and collection of 505 samples for gold assay from trenches, mine dumps etc. indicated presence of gold in the northern group of old workings.

Under Phase II of exploratory programme in 1985-88 by plane table mapping, trenching and drilling, two exploratory boreholes (PB-6 and 23), and 6 boreholes to intersect the mineralisation in the second level (60 m) have been completed.

5. DIMENSION OF ORE BODY :

Gold mineralisation is traced over a strike length of over 400 m. In this, a potential ore lode over a strike length of 155 m with an average width of 1.25 m could be established by drilling upto a depth of 50 m.

6. GRADEWISE RESULTS :

The grade and reserves of the ore body for the I and II level are given below :

ORE BODY	Length (m)	Average width (m)	Vertical depth (m)	Average grade (g/t)	RESOURCES (tonnes)
MAIN LODE (PB-1 to 18)					
I Level	135	1.18	15 to 45	6.05	16,870.78
II Level	53	1.25	45 to 75	2.21	6,701.86
		1.21	15 to 75	4.13	23,572.64
NORTHERN LODE					
PB-4	30	1.00	80	0.35	
PB-21	30	1.00	80	4.34	12,480.00
	60	1.00	80	2.34	36,052.64

To assess the depth continuity of mineralisation upto 12.0 m, two boreholes have already been completed and the third borehole is in progress. In the first borehole (PB-24) four zones of mineralisation from 32.60 to 35.60 m, 178.60 to 179.15 m, 186.40 to 187.20 m and 245.70 to 248.40 m have been encountered. In the second borehole (PB-25) mainly mineralised zones, viz. 164.00 to 166.50 m, 176.15 to 178.50 m and 203.50 to 204.80 m have been encountered. The third borehole is in progress.

7. ORE CHARACTERISTICS :

Native gold occurs in the form of fine dust, disseminations and also as fine inclusions with arsenopyrite. The chief gangue minerals are quartz, carbonates, pyrite and arsenopyrite with minor chalcopyrite and pyrrhotite.

The pyrite and arsenopyrite grains are idiomorphic and exhibit cross cutting as well as parallel relationship with the quartz-carbonate-chlorite rocks. The quartz grain boundaries are sub-rounded with grains showing stretching parallel to schistosity.

In thin section, the auriferous grey quartz shows shearing, granulation, development of crude mortar texture, undulose extinction and stretching.

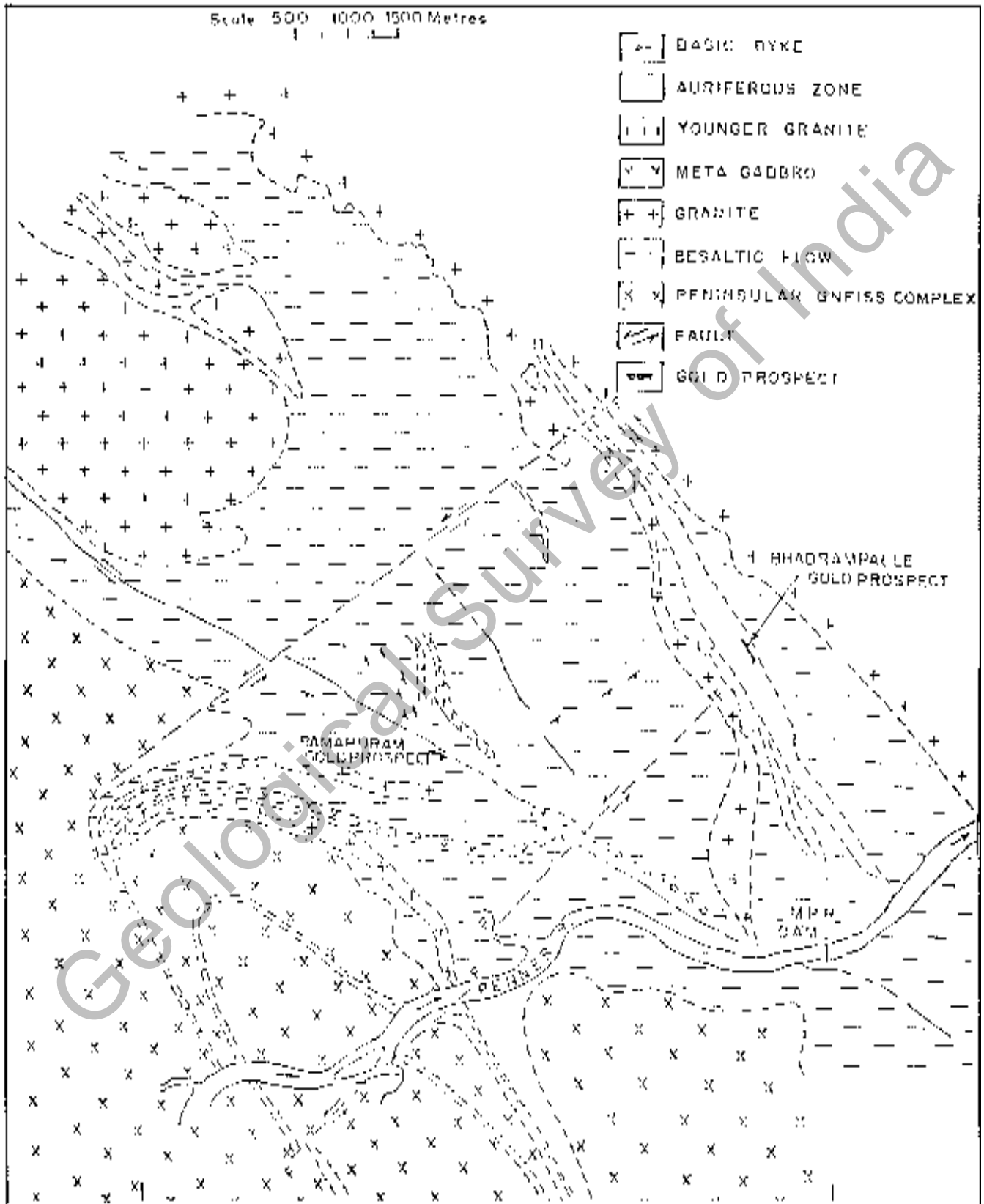
8. RECOMMENDATION IF ANY FOR FURTHER WORK :

Drilling is in progress to assess the depth continuity of mineralisation upto 120 m vertical depth. The old workings and mines., viz. water logged shafts about 60 m deep, adits, inclines and other openings that exist in Bhadrampalli need reclamation for detailed mapping and sampling of these ore shoots.

9. ANY OTHER INFORMATION :

As the present prospect is near the working mines of Ramgiri Gold Fields (about 70 km), these deposits could be evaluated for development as satellite mines.

GEOLOGICAL MAP OF BHADRAMPALLE AND RAMAPURAM GOLD PROSPECTS,
PENAKACHERLA - SCHIST BET, ANANTAPUR DIST., ANDHRA PRADESH



C. Kottapalle Prospect

1. LOCATION :

- | | | | |
|----|-----------------------|---|---------------------------------|
| a) | Belt name | : | Ramagiri-Penakacherla - Hungund |
| b) | Prospect/Deposit name | : | Kottapalle block |
| c) | Location | : | About 28 km SW of Dharmavaram |
| d) | District | : | Anantapur |
| e) | Mandal | : | Dharmavaram |
| f) | Village | : | Kottapalle (57-F/7) |
| g) | Latitude | : | 14°20'20" |
| h) | Longitude | : | 77°29'20" |

2. GENERAL GEOLOGICAL SET UP :

The Kottapalle block comprises metabasalt (massive and fissile), linear bands of chlorite/sericite schist traversed by auriferous quartz/carbonate veins and lenses, acid tuff with thin lamellae of chert, banded ferruginous quartzite, carbonaceous phyllite, meta gabbro and dolerite dykes. These rocks are flanked by Peninsular Gneissic Complex (PGC).

The chief host for mineralisation is chlorite schist, within which narrow zones of light grey highly fissile quartz-chlorite-sericite schist occur with thin stringers and lenses of sheared quartz/ankerite that are found auriferous. This particular unit shows a negative topography compared to chlorite schist and metabasalt. The bands are narrow with widths varying from 1.00 to 1.50 m and extend along the strike from 15 to 600 m. These bands, at places, coalesce to form a wider zone.

Three types of quartz veins are emplaced in quartz-sericite-chlorite schist- a) thin stringers and lenses of grey/smoky, sheared quartz with sulphides, b) light grey quartz with black carbonate with sulphides, and c) late white opaque massive quartz veins. The first two types have suffered deformation and are gold bearing.

The light grey medium to coarse grained acid volcanic unit with thin layers of chert (occasionally sulphidic) is the second unit after the metabasalt in respect of thickness.

Bands of ferruginous quartzite, at places sulphide bearing, are usually present on the eastern part of Kottapalle block and occupy the contact zone of acid tuff and basic rock.

Carbonaceous phyllite with grey quartz veins and some sulphides also occupies the contact zone of acid and basic volcanics, while meta-gabbro is present at the contact of hornblende schist and acid tuff. A number of dolerite dykes cut across different formations which trend E-W to ENE-WSW with thickness varying from a few centimetres to 50 m.

3. CONTROLS OF MINERALISATION :

In Ramagiri Gold Field, gold-bearing sulphide occurs in sheared grey to smoky quartz veins (associated with carbonate) emplaced in quartz-chlorite sericite/quartz sericite schist which are the product of shearing-cum-alteration of original lava (andesitic) at a late stage of folding with the release of silica. The ductile shear zones represent the main avenues for localisation of gold in narrow passage way with the adjoining rocks altered to sericite bearing unit. The quartz bodies that formed early and underwent further shearing were favourable to gold emplacement. Concentration is highest in shear folded quartz bodies especially in the synclinal portions. The maximum dimensions of ore shoot is in pitch direction which is 45° to 80° towards north. Important ore shoots show en-echelon distribution which on the whole is dextral.

4. TYPE OF EXPLORATION AND PHYSICAL QUANTUM OF WORK

Name work	Physical quantum of work carried out upto the end of 1991-92 F.S.P.
a) Detailed geological mapping on 1:2,000 scale (sq km)	2.85
b) Drilling (m)	5,119.20
c) Pitting/Trenching (cu m)	2,747.00
d) Samples (nos)	
i) Trench	2,003
ii) Core	1,591

The area is dotted with old mine workings.

During 1981-84, exploratory work carried out revealed five sub-parallel auriferous zones over a cumulative strike length of 13.60 km with width varying from 1 to 40 m. Out of the five zones, namely Zone-I, II, IIIa and IV, zones II and III indicated better gold values in trenches. Trenches excavated on the southern part of Zone-II analysed upto 4.2 g/t of gold, out of the 22 boreholes drilled, only in five holes intersections with more than 1.00 g/t of gold were obtained and in the remaining boreholes values ranged from 0.10 to 0.40 g/t. The boreholes in all the zones were spaced at 300 m to 400 m.

Reassessment of the boreholes and trench analytical data followed by resampling of all the zones resulted in delineating 750 m long mineralised zone (in Zone II) in the western part of this block during 1987-88 and accordingly 12 boreholes were drilled with a spacing of 50 m interval. This reassessment work led to the establishment of 140 m long mineralised zone in the central part of the Zone-II assaying 3.29 g/t of Au over a true width of 1.45 m.

Deep probe drilling is being carried out to find out the strike and depth persistence of gold mineralisation. These boreholes drilled to intersect the lode at 150 m RL. have intersected mineralisation at expected depths. Results received from the borehole BHK-35 assayed 0.135 g/t of gold over a width of 1.40 m.

5. DIMENSION OF ORB BODY :

The ore body in Kottapalle block as determined by drilling is 140 m long with an average width of 1.45 m. The ore body has been proved upto a depth of 60 m and depthwise probing as in progress. Boreholes BHK-35, 36 and 37 drilled at vertical intersection of 150 m in Zone-II indicated the strike and depth persistence of mineralisation.

6. GRADEWISE RESULTS :

Based on the intersections at 60 m a probable reserve of the ore body has been calculated (at 1 g/t cut off grade over a minimum stopping width of 1.20 m). A total of 33,048 tonnes of ore or an average grade of 3.29 g/t has been established upto a depth of 60 m over a strike length of 140 m (area of influence of 50 m is taken into account). The ore reserve estimate shown above is tentative as the work is in progress. After the receipt of the analytical data in respect of

boreholes aimed at 150 m intersections, a revised probable reserve estimate will be made upto a depth of 150 m. boreholes BHK-35, 36 and 37 drilled at vertical intersection of 150 m in Zone-II indicated the strike and depth persistence of mineralisation. Based on the sulphide intersections encountered in all the boreholes, the mineralised zone has been deciphered over a strike length of 190 m.

7. ORE CHARACTERISTICS :

The gold is in native form, of the free milling type and generally fine in grain size. The ore is also found associated with pyrite, chalcopyrite and arsenopyrite. No telluride is found. Arsenic values of ore samples vary between trace and 50 ppm, being mostly less than 50 ppm, sporadically upto 2500 ppm. The sulphur content in different ore samples varies between 0.5 to 1.7% representing 1 to 4% sulphides. The copper content is about 0.3%, Pb and Sn are in traces and Bi and Te are absent . Sb in ore is less than 50 ppm, a few gave about 100 ppm. Ag values range from trace to 3.2 g/t. Tungsten in the form of scheelite is also associated with grey quartz but is very sporadic, meagre in concentration and quantity.

The gold of economic interest is concentrated mainly in quartz bodies but occurs also in adjoining schistose rocks having veinlets and thin hair-like stringers of quartz. The gold values are highly variable widthwise as well as lengthwise showing preference for the hanging wall side.

8. RECOMMENDATION FOR FURTHER WORK :

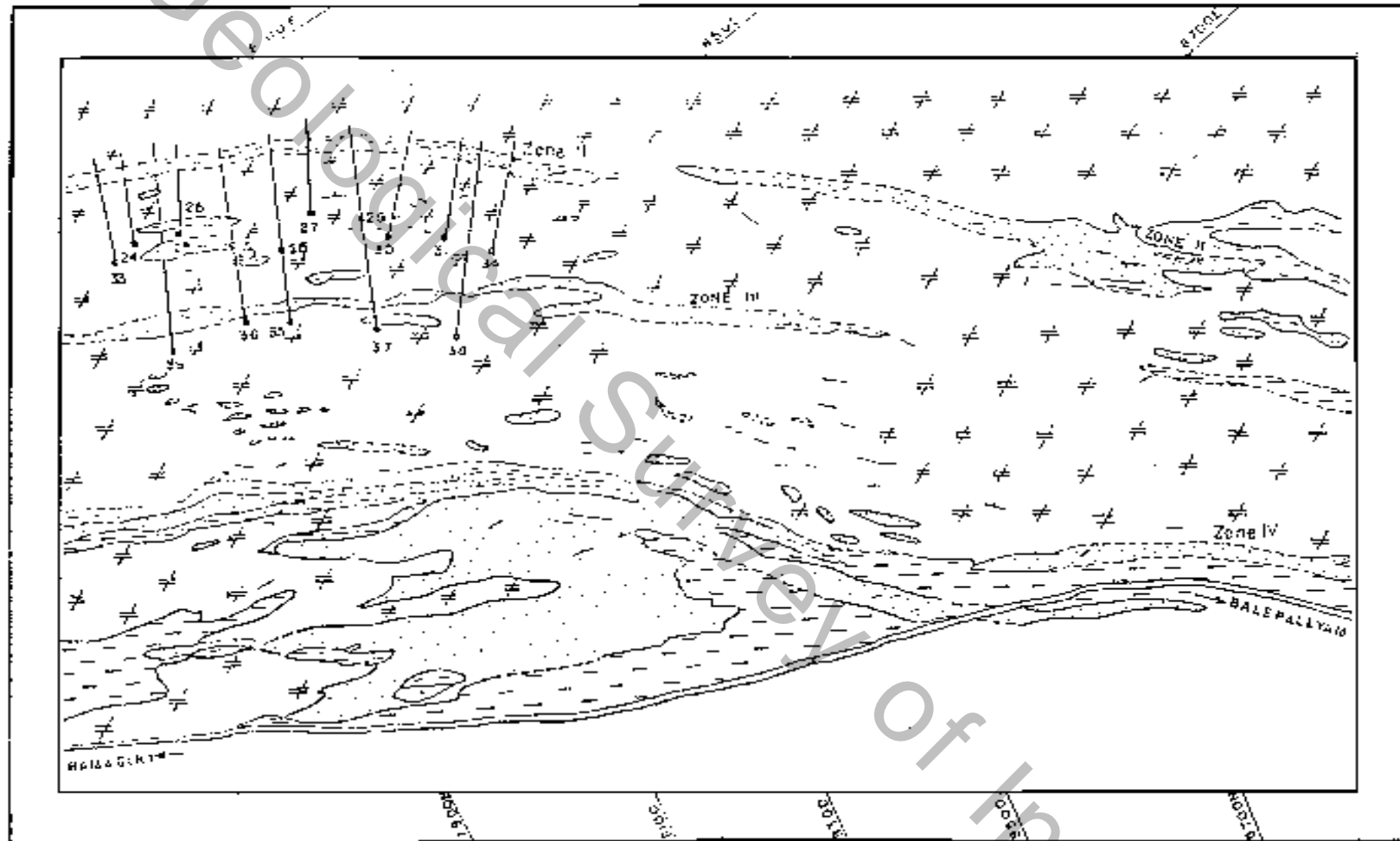
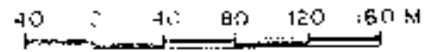
A tentative reserve of 33,048 tonnes of an average grade of 3.29 g/t has been established upto 60 m vertical depth and depthwise probing of the ore body is continued.

Smaller zones in III and IV which are interesting can be explored by trenching and drilling along with other quartz-ankerite zones further east of Zone IV.








9. ANY OTHER INFORMATION :

Yeppamana is an active mine in the neighbourhood in Ramagiri Gold field being mined by BGML. The average production of gold from this mine is about 12-13 kg per month.

GEOLOGICAL MAP OF KOTTAPALLE BLOCK, RAMAGIRI GOLD FIELDS,
DISTRICT ANANTHAPUR, ANDHRA PRADESH



I N D E X

- | | | | | | |
|---|---------------------------|---|--|---|------------------------------|
|  | Bore Hole with no. |  | Quartz vein |  | Dark grey Phyllite |
|  | Strike & dip of foliation |  | Chlorite-Sericite-Phyllite with Secondary Carbonates |  | Greenshale Massifs & Fissile |
| | |  | Unmapped area | | |

D. Chennabhavi block

1. Location 14°19'00"-14°20'00"/57F/11 77°30'45"-77°31'
Northern part of RG.F. Just north of Kottapalle block.
2. General geological set-up The block comprises variably sheared spotted metabasalt. The highly sheared varieties are "phyllitic" in nature. The main Chennabhavi lode is represented by a well-defined quartz vein trending N 35°E-S 35°W with steep (75°) dip to the east. Wall rock alteration include carbonatisation, sericitisation, chloritisation, pyritisation. Parallel reefs are also present.
3. Control of mineralisation The auriferous quartz veins are conformable to the shear zone and host gold mineralisation. The adjacent schist is very poor in gold content (100 to 200 ppb.). The northern ore shoot has a definite northerly pitch whereas the southern ore shoot is indeterminate.
4. Type of exploration and physical quantum This block is known to have produced the richest ore from this field in the early part of this century till about 1927. A total of 0.26 m.t. of ore at an average grade of 15 g/t of gold was won from two ore shoots over a total mine development of 9,300 m. Reopening the mine at one level (450 ft.) in 1973 did not reveal any additional ore within the mine section. Test drilling for identifying unstoped gap areas at the upper levels indicated 4.2 to 4.8 g/t of gold over 0.40 to 0.50 m. width in first three boreholes.
5. Dimensions of the ore body The main lode is known over a strike length of 975 m. Its northern extension is open. The maximum width is known to be 21 m. The northern ore shoot had a strike length of 140 m a pitch length of 250 m. The southern ore shoot has a length of 105 m and bottomed

rapidly at 250 ft level. A blind ore shoot is known from 950 ft level at the northern end of the mine over 102 m length with 15 g/t of gold over 1.2 m. width.

- | | |
|------------------------|---|
| 6. Gradewise reserve | Grade and reserve of unstoped ground and extensions to be assessed. |
| 7. Ore Characteristics | Gold-quartz lode, free-milling type. |
| 8. Remarks | Existence of blind and rich orebody remains a distinct possibility. Exploration at deeper levels may be a worthy proposition. |

Geological Survey of India

E. Penakacherla - Kuderu block

1. LOCATION :

Belt name	: Ramgiri-Penakacherla Hungund
Prospect/Deposit name	: Penakacherla-Kuderu block
Location	:
a) District	: Anantapur
b) Mandal	: Uravakonda
c) Village	: Penakacherla
d) Toposheet	: 57-F/5
Latitude	: 14°44' - 14°52'
Longitude	: 77°25' - 77°27'

2. GENERAL GEOLOGICAL SET UP :

The Penakacherla- Kuderu block lies between two well known gold deposits, viz. Ramgiri gold fields in the south (about 90 km), which are presently producing gold, and the Ramapuram-Bhadrapalli old workings in the north, which were worked by M/s John Taylor & Sons during the period from 1924 to 1927.

The rocks exposed in the Penakacherla-Kuderu block comprise metabasalt, chlorite sericite schist, sericite schist, banded ferruginous quartz and carbonate bands with basic intrusives. Two lamprophyre bodies have been recorded, one adjacent to Kalagell old working and the other 3 km east of Antarganga, The field disposition of Kalagalla lamprophyre is similar to a semicircular plug whereas the Antarganga lamprophyre occurs as a dyke. Besides the above rock types, a persistent band of meta-pyroxenite is traced all along the western margin of the schist belt. The rocks have undergone green schist to lower amphibolite facies of metamorphism.

3. CONTROLS OF MINERALISATION :

In Penakacherla-Kuderu block gold mineralisation is associated with sulphides which include pyrite, chalcopyrite, arsenopyrite and pyrrhotite. The

most favourable locales are chlorite-sericite schist emplaced by quartz-sericite-ankerite veins. Quartz veins are distinguished as blue grey, greyish white, cherty sulphidic and white quartz. The white quartz veins are devoid of any mineralisation. The surface manifestations of the mineralisation include alteration zones, viz. sericitisation, chloritisation and occasional oxidation of primary sulphides. The quartz and ankerite veins are impersistent and vary in length from less than a metre to 20 m and width from 5 m to 2 m.

4. TYPE OF EXPLORATION AND PHYSICAL QUANTUM OF WORK :

Completion of systematic geological mapping on 1:63,360 scale of the area was followed by geochemical surveys and large scale mapping on 1:15,840 scale in 1981 for the purpose of delineating the probable areas of gold and multimetal sulphide mineralisation.

a)	Reconnoitary mapping (sq km)	50
b)	Large scale mapping on	
	i) 1:15,840 scale (sq km)	26
	ii) 1:12,500 scale	26
c)	Detailed mapping on	0.5 in Kalagalla area
	1:1,000 scale (sq km)	0.5 in Penakacherla
d)	Trenching (cu m)	237 in Penakacherla area-11 trenches
		50 in Kalagalla area - 5 trenches
e)	Drilling (m)	374.50 in Kalagalla upto 60 m level
f)	Samples (nos)	
	i) Lithochemical	305 + 347 + 332 = 1,184
	ii) Core	54
	iii) Geobotanical	111

OLD WORKINGS/PROSPECTING PITS :

In Penakecherla-Kuderu block, there are old workings/prospecting pits in three areas, viz. Marutlathurupuru, Kalagalla and Nagireddipalli. Nature of old workings locality wise is given below :

Marutlathurupuru: Two groups of old workings/prospecting pits have been located about 2.5 km northwest of Marutlathurupuru over a strike length of about 65 m and 56 m with a maximum width of 10 m and 22 m respectively. These workings are shallow depressions with much dump material strewn around. They are separated by 200 m. located within chlorite-sericite schist traversed by grey and white quartz and ankerite veins with occasional specks of sulphide minerals in quartz and ankerite veins. Samples collected analysed gold values ranging from 0.25 ppb to 1.4 g/t. In Marutla block three chargeability zones corroborated by EM poor conductor were recorded over quartz-ankerite extending over a strike length of 400 m.

Kalagalla: A deep-filled pit/shaft of 30 m in length, 5 m in width and about 8 m depth has been located 3 km north-east of Kalagalla within chlorite-sericite schist flanked on either side by metabasalts. The southern end of old working is flanked by sheared, weathered, carbonatised blue lensoid quartz veins, which occupy the hinge portion of steeply plunging F2 fold. Exploratory drilling was carried out in the old working area. Out of four boreholes of 60 m vertical depth drilled, only one (KBH-1) encountered mineralised zone assaying 6.2 ppm of gold over 30 cm. The average grade over 90 cm is 2.41 g/t. Interesting values of tungsten 30 ppm. and 35 ppm have also been obtained. In Kalagalla block, geophysical surveys comprising IP, SP and EM methods indicated an IP anomaly zone around old workings over a strike length of 200 m with a conspicuous low magnetic zone enveloping the chargeability zone presumably signifying alteration zone.

Nagireddypalle: Five small shallow trenches/pits which are mostly filled up are noticed 600 m east of Nagireddypalle within comparatively less schistose chlorite-carbonate schist. All these workings are located within cultivated land. Sheared grey quartz veins with occasional specks of sulphides are seen traversing the old workings. Detailed geochemical and test geophysical traverses were carried out in this area. The geophysical survey indicated a prominent IP anomaly zone falling in the strike extension of the prospecting pits.

F. PENUKONDA PROSPECT

1. LOCATION :

- | | | |
|----|-----------------------|---------------------------------|
| a) | Belt name | : Ramagiri-Penakacherla Hungund |
| b) | Prospect/Deposit name | : Penukonda |
| c) | Location | : Penukonda |
| d) | District | : Anantpur |
| e) | Mandal | : Penukonda |
| f) | Village | : Bokkasampalli |
| g) | Toposheet | : 57 - F/12 |
| h) | Latitude | : 14°06'30" |
| i) | Longitude | : 77°32'20" |

2. GENERAL GEOLOGICAL SET UP :

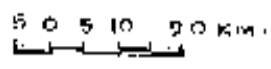
The area forms the southern part of the Ramagiri-Penakacherla schist belt which is curvilinear in shape and trending NNW-SSE to NW-SE. It consists of metavolcano-sedimentary suite of rocks represented by hornblende schist, metabasalt, talc-tremolite schist, amphibolite, chlorite schist, quartz sericite schist, quartzite and banded iron formation flanked on either side by granitoids and gneisses of Peninsular Gneissic Complex. The rocks are traversed by younger granitoids, dark grey/white quartz/ankerite veins and gabbroid/dolerite dykes.

The width of the belt is variable from 1.5 to 2 km in the area. The rocks have suffered at least four phases of successive deformations. The general grade of metamorphism is green schist facies. It has attained amphibolite grade of metamorphism in zones of intensive shearings and deformation and near to intrusive granite complex. Regional geochemical surveys helped in delineation of five auriferous zones in Penukonda area.













1. Quartz vein zone
2. Ankerite zone
3. West zone
4. South zone, and
5. Penukonda zone.

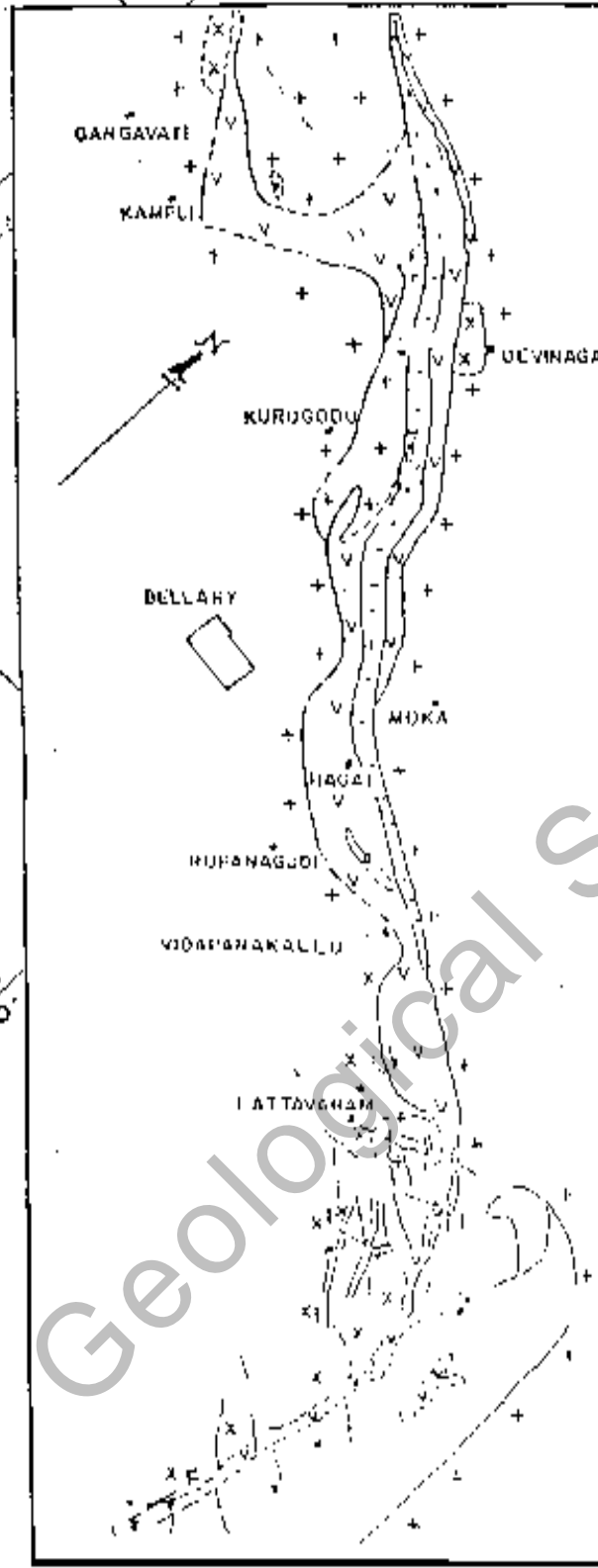
GEOLOGICAL MAP OF PENAKACHERLA BELT ANDHRA PRADESH & KARNATAKA

SCALE



INDEX

-  DYKES
-  INTRUSIVE GRANITOIDS
(TONALITE, GRANODIORITE, GRANITE)
-  GABBRO
-  BANDED IRON FORMATION
-  META SEDIMENTS
-  BASIC VOLCANICS
-  STRIKE AND DIP OF FOLIATION
-  SHEAR
-  PILLOW
-  PLUNGE OF MINOR ANTIFORM
-  ANTIFORM
-  FAULT



Detailed mapping on 1:1,000 scale was carried out in all other zones except in the west zone.

Quartz vein zone:

The quartz vein zone is located 2.5 km NNE of Bokkasampally village and 1 km east of 679 hill within metavolcanic suite of rocks represented by metabasalt, diorite schists and quartz sericite schist, etc. intruded by younger grey granite. The rocks show almost N-S trends with moderate to very steep dips on either side, i.e. east/west.

Two parallel and sheared quartz veins extends over a total strike length of 400 m with width varying from 5 to 25 m. These are gossanised and stained heavily with limonitic and arsenic encrustations. Chalcopyrite, pyrite, scheelite, pyrrhotite and calcite are the associated minerals. A total of 67 bed rock samples and one hundred trench samples collected in the zone assayed 0.2 to 3.0 g/t of gold.

Drilling in 5 boreholes established the two parallel quartz veins exposed on the surface to coalesce at depth thereby increasing the width almost doubly to 50 m over a proved strike length of 250 m. Analytical results of the boreholes are as follows :

B.H.No.	Angle/ bearing	Vertical intersection depth (m)	Total (depth) (m)	Range of Au		Remarks
				Min.	Max.	
BBH-1	45°/E	60(570m RL)	166.25	0.025	2.36	
BBH-2	50°/E	60(570m RL)	75.45	0.10	1.55	Abandoned due to drilling problem
BBH-3	55°/E	120(470m RL)	200.00	0.025	1.15	
BBH-4	50°/E	90(450m RL)	246.35	0.025	1.10	3800 ppm of Tungsten (175-176.60m) depth.
BBH-5	45°/E	60	152.40	0.10	2.20	

Ankerite zone :

The ankerite (quartz) vein zone is located 1.5 km WNW- ESE of Nallakonda, i.e. 773 hill in the metavolcanic suite of rocks. The rocks show almost N-S trends with steep dips towards either east or west. The ankerite-quartz body is light brown to dark brown or buff in colour and fine to medium in grain size.

The ankerite zone has a strike length of 400 m with width ranging from 4 m to 70 m and trends in N-S direction with subvertical dips due westerly. Wall rock alteration is recorded in the form of sericite, chlorite, epidote, serpentine and carbonate mineral.

A few close-spaced composite samples collected on grid pattern in the zone assayed low values for gold (g/t).

South zone:

The south zone is located 3.5 km south of Bokkasampally village and situated on the Penukonda-Roddam all weather metalled road.

The zone exposes different varieties of metavolcanites (massive, schistose and pillowed metabasalts), chlorite schist, sericite schist and hornblende schist. Highly sheared/jointed, fine grained, greyish quartz vein is seen exposed over a strike length of 150 m with variable width ranging from 0.5 m to 6 m. Wall rock alteration is marked by the extensive development of sericite, ankerite, chlorite, epidote and kaoline minerals.

Initially three bed rock samples collected from quartz assayed 0.3, 0.6 and 0.7 g/t of gold. Later a total of 37 samples was collected in the zone and all assayed low values of gold, i.e. # ppb only.

Two boreholes were drilled in the south zone. They are as follows :

B.H.No.	Angle/ bearing	Vertical intersection (depth)(m)	Total depth (m)	Range of Au values in g/t		Remarks
				Min.	Max.	
SBH-1	50°/E	30(600 m RL)	53.80	0.210		
SBH-2	45°/E	60(570 m RL)	90.00	0.360		

SBH-1 and SBH-2 boreholes assayed poor values for gold at the shallow levels. It is possible that at deeper levels (450-470 m RL) as revealed in the table below, better mineralisation may be expected in this area.

Sl. No.	Area	Surface (m RL)	RL of inter-section of mineralisation (m RL)	Average assay range	Remarks
1.	Ramapuram	420	380	5.6 g/t	North of the R-P schist belt
2.	Bhadrapally	406	380	6.0 g/t	
3.	Chennabhavi	530	470	9 dwt/t	South of the
4.	Yappamana mines (Ramagiri)	527	460	5-15 dwt/t	R-P schist belt
5.	Penukonda	620	570	1-1.5 g/t	

Penukonda Zone :

It is located 3.5 km WNW-ESE of Penukonda town and situated on the eastern margin of the schist belt on Penukonda Roddam road exposing only hornblende schist unit of metavolcanic suite intruded by quartz apatite veins \pm garnet and greyish quartz veins. A series of parallel, N-S trending quartz epidote veins \pm garnet bodies are exposed over a strike length of 300 m with a variable width ranging from a few centimetres to 2 metres. Limonitisation, chloritisation and kaolinisation are recorded as wall rock alteration. The core samples of one single bore hole (45 m vertical depth) has not indicated any significant gold values.

West Zone :

It is located 2.25 km north of Bokkasampally village on 679 m hill. It exposes hornblende schist/meta-pyroxenite bodies, quartz sericite schist/ and are intruded by grey granite and quartz veins. ENE-WSW trending 50 m long and 15 m wide, grey coloured, very fine grained brecciated quartz vein/chert (?) with profuse sulphides, i.e. pyrite and arsenopyrite occurring as disseminations is

recorded/mapped. A few surface samples collected from the zone (quartz vein) assayed upto 1.5 g/t of gold. No drilling was carried out In the zone.

3. CONTROLS OF MINERALISATION :

Gold mineralisation is generally associated with quartz/ankerite/apatite veins located along the N-S and NNW- SSE trending shears passing through younger granitoids and the schists. Origin of gold in this belt might be in two phases viz. (1) sulphide associated gold localised from meta-volcanic suite of rocks and (2) free milling gold with subordinate sulphide associated gold derived from granite and quartz apatite veins.

4. TYPE OF EXPLORATION AND PHYSICAL QUANTUM OF WORK :

Nature of work	Quantum of work
1. Regional Geochemical Surveys on 1:12,5000 scale (sq km)	57
2. Detailed geological mapping on 1:1,000 scale (sq km)	1
3. Pitting/Trenching (cu m)	150
4. Drilling (m)	1263.15
5. Samples (Nos)	
i) Bed rock	730
ii) P/T	100
iii) Core	623

5. DIMENSION OF ORE BODY :

The quartz vein zone runs for a strike length of 400 m with widths ranging from 5 to 20 m. was proved upto a depth of 120 m.

In the other zones one or two boreholes were only drilled.

6. ORE CHARACTERISTICS :

The mineralisation is mostly associated with sulphides, i.e. chalcopyrite, pyrite, pyrrhotite and occasionally arsenopyrite and bornite. Quartz, ankerite, calcite and rarely chlorite form the gangue minerals. Mineralisation occurs in the form of dissemination, stringers, veinlets, lumps and chunks.

III. Kolar Schist Belt

Kolar schist belt is the richest 'gold belt' of India and ranks among some of the foremost similar greenstone belts of the world. The deposit at K.G.F. located in the centre of the belt has so far produced about 46 million tonnes (m.t.) of gold ore at an average recovered grade of 16 grams of gold per ton of ore. The high grades of ore used to come from the 'Champion lode' which is mostly mined out. During the last decade, the average grade of ore from K.G.F. hovered between 3 and 5 g/t and has been contributed mainly by sulphidic lodes which are of much lower average grade.

The bulk of the 80 km long and linear Kolar schist belt measuring 400 sq km in aerial extent is made up of supracrustal rocks comprising metamorphosed basic lsbsd, svif lsbsd, yuggd, B.I.F. graphite-sulphide schists and polymict conglomerate. The rocks of the schist belt show three phases of folding and low pressure amphibolite facies of metamorphism. Recent radiometric dating indicated around 2700 m.y. for the metamorphosed basic volcanic rocks of the belt (Sm-Nd and Pb-Pb method). The surrounding intrusive gnesisses yielded around 2600 m.y. (U-Fb method).

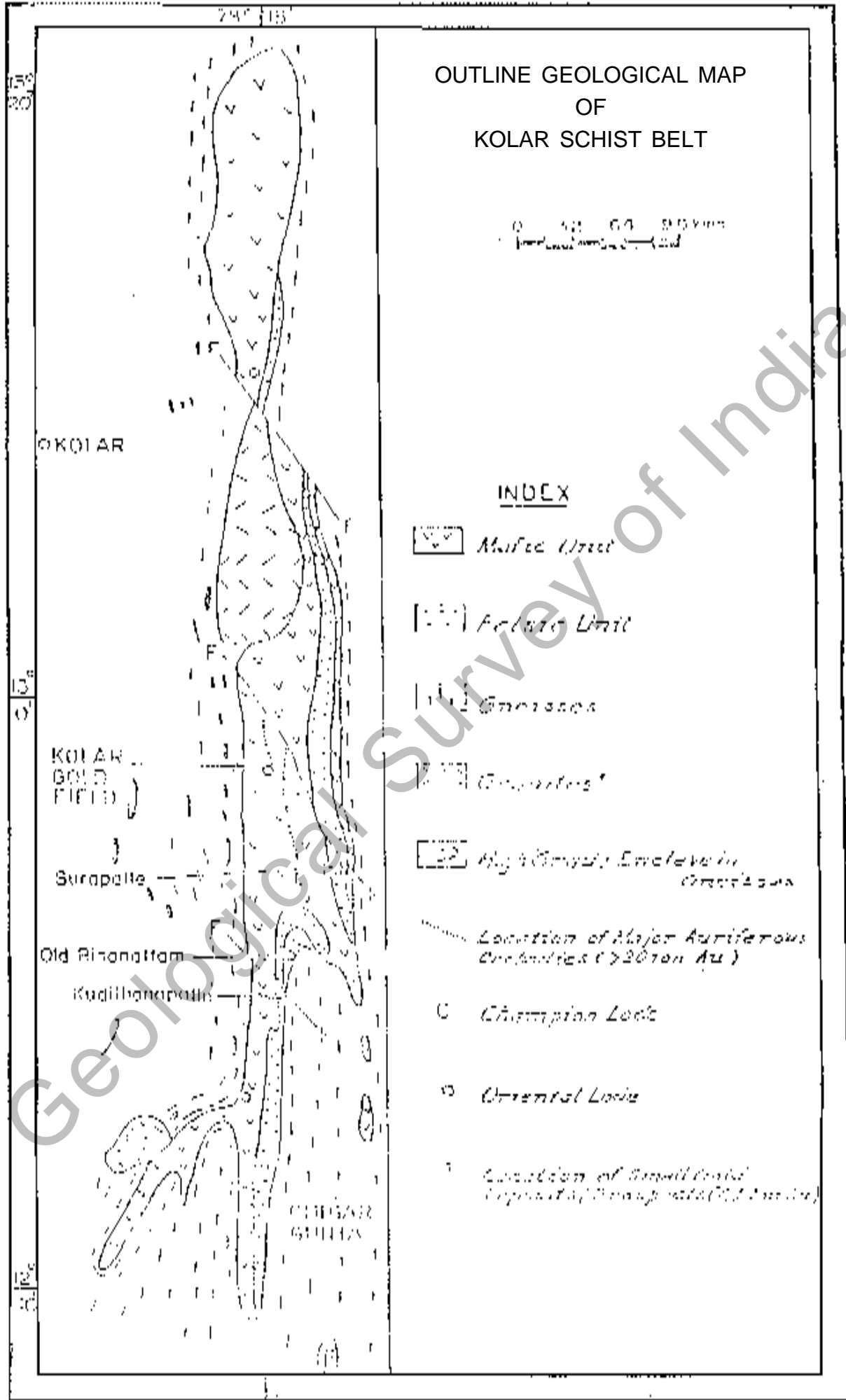
Broadly two types of gold mineralisation i.e. gold-quartz (free-milling type) and gold-sulphide-quartz lode (refractory type) have been identified from this belt.

Apart from the deposit at K.G.F., many gold prospects and occurrences are known from this belt and deserve attention from the exploration point of view.

A. Surapalle Prospect

1. Location : Surapalle village 12°55'30", 78°17'00", 57L/5 East of Mysore Mine of Kolar Gold Fields, Kolar district, Karnataka.
2. Geological set up : The area is underlain by an interbanded sequence of metaacid tuff and polymict conglomerate ('Champion gneiss') of Kolar schist belt. The regional strike of foliation is N20°W-S20°E with steep (60°-70°) dip to west.
3. Control of mineralisation : Several auriferous shear zones traverse these rocks. These are represented by quartz veins / stringers in hydrothermally altered host rocks with arsenopyrite and pyrite. The auriferous zones are very nearly conformable to the regional foliation.
4. Quantum of work done:

Detailed mapping	:	0.04 sq km on 1:1000 scale
Trenching	:	398 cu m
Drilling	:	3,198.10 m in 22 boreholes
Sampling	:	810 nos
Geochemical soil Sampling	:	514 nos
5. Dimension of ore body : A cumulative strike length of 310 m. has been established on 2 subparallel lodes. The width varies from 1.18 m to 1.93 m.



OUTLINE GEOLOGICAL MAP
OF
KOLAR SCHIST BELT

0 40 60 80 YMS
Scale bar

INDEX

- Maifec Unit
- Archaic Unit
- Gneisses
- Quartzites
- High Kinship Enclave in Cratons
- Location of Major Auriferous Creeks (>20 ton Au)
- Champion Lead
- Oriental Lead
- Location of Small Gold Deposits (Group rate 0.5 ton Au)

KOLAR

KOLAR GOLD FIELD

Sirapalle

Old Binanattam

Kudihannur

CHINNAR GULLY

13° 20'

13° 0'

13° 20'

79° 13'

6. Grade / Reserve : A probable reserve of 0.1 million tonnes upto 120 m depth has been established for the main lode (217 m strike length) with an average grade of 4.55 g/t gold. In addition 0.014 million tonnes has been established for the hanging wall lode (93 m strike length) with an average grade of 7.51 g/t of gold.
7. Ore characteristics : Free-milling type.
8. Recommendations : The prospect is adjacent to the working mines of Kolar Gold Fields and may become amenable for small scale mining.

B. Chigargunta block - IV West

1. Location : 12°43':78°14'30", 57L/2, A block within the Chigargunta gold prospect which is under active exploitation, Chittoor dt, A.P.
2. Geological set up : Two rock units form the bulk of the schist belt. A mafic unit occupying the Western portion of the schist belt comprises hornblende schist/gneiss, amphibolite and ultramafic schist. Chemically the mafic schist shows tholeiitic basalt parentage. A felsic unit comprising metamorphosed dacitic tuff occurs to the east of the schist belt. The rocks are isoclinally folded and appear to have resulted from E-W compression. Gold mineralisation occurs both in mafic and felsic schist and is structurally controlled in ductile set of shear zones.
3. Control of mineralisation : The auriferous shear zone occurs at the contact of mafic and felsic schist and trends N-S with steep dip to the east (70°). The zone is tabular, sheet like and contains quartz and little pyritic sulphide.
4. Quantum of work done:

Detailed mapping	:	0.16 sq km on 1:1000 scale
Trenching	:	59 nos and 2881.15 cu m
Number of boreholes	:	15 nos and 1521.35 m
Sampling	:	687 (Surface/boreholes)

5. Dimension of orebody : Gold mineralisation occurs over a strike length of 400 m. Width varies from 0.20 m to 8.5 m, the average being 1.70 m. Three more parallel mineralised zones occur to the footwall of the main lode.
6. Grade / Reserve : Possible- 0.6 mt at 3.34 g/t
7. Ore characteristics : Free-milling type.
8. Recommendations : The lode forms the southern extension of a 1 km long zone. The northern 600 m indicated encouraging result. Shallow level development recommended.

Geological Survey of India

C. North of Block-I, Chigargunta

1. Location : 12°44':78°14'30", 57L/2, The prospect lies just 400 m north of Chigargunta mine.
2. Geological set up : Geological set-up same as Chigargunta block-IV (West).
3. Control of mineralisation : The auriferous shear zone comprise hydrothermally altered hornblende schist with stringers of quartz and sulphides. The zone is N-S trending, lenticular and subvertical in attitude. Ore occurs in two pitching shoots.
4. Quantum of work done:
 - Detailed mapping : 0.13 sq km on 1:1000 scale
 - Trenching : 1,454 cu m
 - Drilling : 2,025.05 m in 14 boreholes
 - Sampling : 1,023 nos.
5. Dimension of orebody : The zone has been traced over a strike length of 150 m the average width being 2.00 m. The ore shoots have been established upto a vertical depth of 90 m by drilling.
6. Grade / Reserve : Probable - 0.03 mt at 12.34 g/t
7. Ore characteristics : Free-milling type.
8. Recommendations : The ore is high grade and may act as a sweetner to the generally low grade ores of Chigargunta.

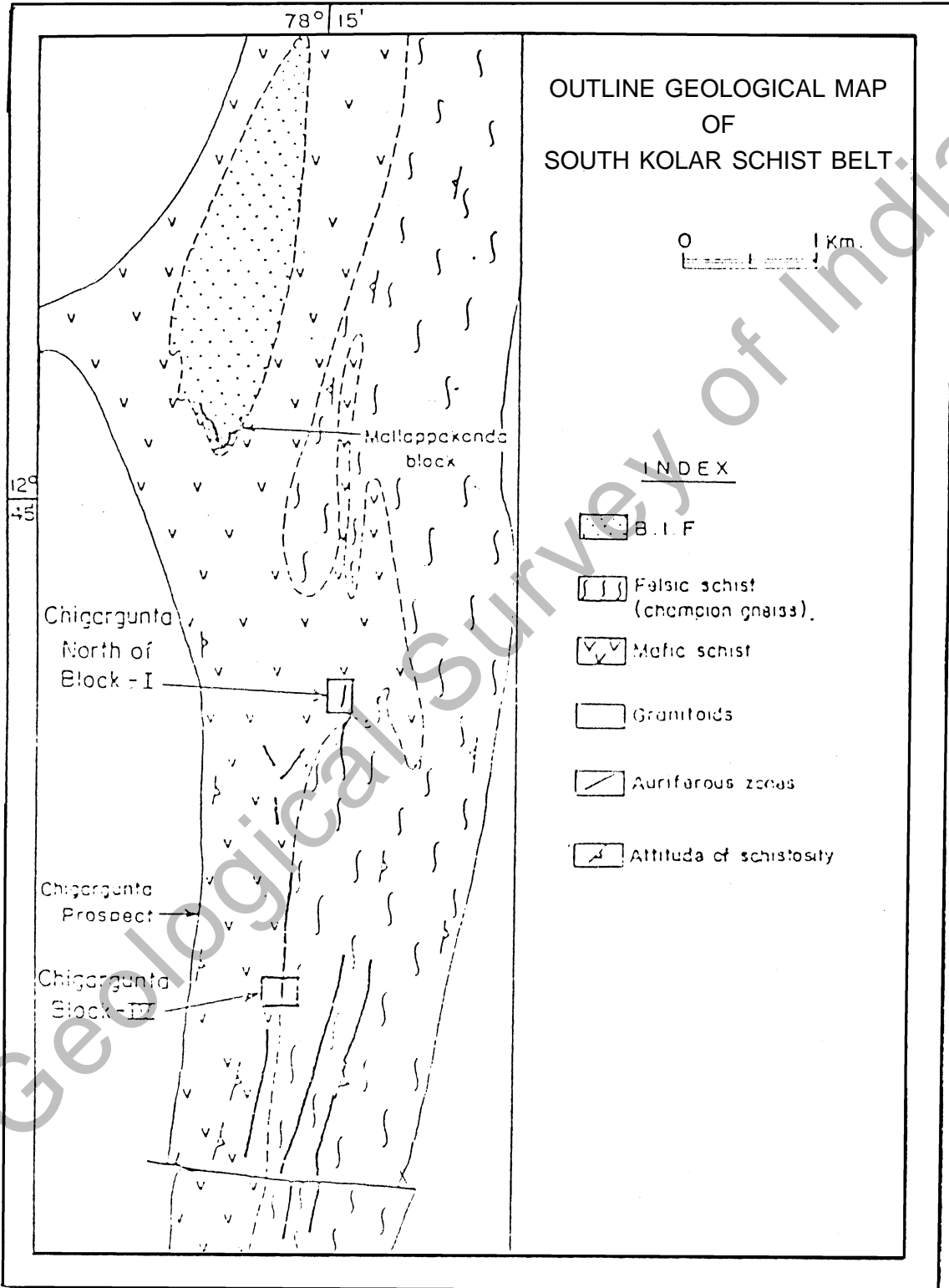
D. Mallapakonda Block

1. Location : 12°46' : 78°14', 57L/1. About a kilometre north of the Chigargunta gold prospect which is under active exploration, Chittor district, A.P.
2. Geological set up : Banded amphibole (\pm Sulphide) quartzite, magnetite quartzite, amphibolite, felsic schists are the principal rock types which are tightly folded on N-S trending axes. BIF is the host rock for gold mineralisation. The schistose rocks are metamorphosed to amphibolite facies and are intruded by surrounding granitoids. A volcano-genic model for the precipitation of auriferous BIF has been favoured.
3. Control of mineralisation : Gold mineralisation occurs in banded amphibole-sulphide quartzite localised along the closure of an antiformal fold. Native gold occurs in arsenopyrite, which along with pyrrhotite and amphibole forms massive layers alternating with quartz. The auriferous sulphidic layers have been metamorphosed and deformed along with the enclosing rocks. Ore bodies are subvertical.
4. Quantum of work done:

Detailed mapping	:	0.70 sq km on 1:2000 scale
Trenching	:	115 cu m
Drilling	:	3,901.70 m in 18 boreholes
Sampling	:	1333 nos.

Geophysical I. P. survey along with magnetic was also carried out. 2-level exploratory mine development was also carried out.

5. Dimension of orebody : The auriferous zones are lensoid in shape and disposed en-echelon pattern with width ranging from a metre to a maximum of 40 m and traced over a length of 450 m. In the Western limb, three subparallel ore zones over a strike length of 150 m was delineated. Ore continuity established over a depth of 200 m from surface by 2- level drilling.
6. Grade / Reserve : Proved - 141000t at 2.73 g/t
 Probable- 206000t at 2.21 g/t
 Possible- 426000t at 2.52 g/t
 (Total) - 773000t at 2.47 g/t
7. Ore characteristics : Native gold ranging in size from 5 to 50 microns is included only in arsenopyrite. Ore refractory, laboratory scale beneficiation study has already been carried out.
8. Recommendations : Large average width (15m), low grade, steep dip and high topography make the prospect an open-cut proposition.



E. Old Bisanattam Mine Prospect

1.
 - a) Belt Name : Southern extension of Kolar Schist Belt
 - b) Prospect : Old Bisanattam mine area
 - c) Location : About 5 km south of Kolar Gold Field
 - d) District : Chittoor
 - e) Mandal : Kuppam
 - f) Village : Bisanattam
 - g) Toposheet : 57-L/5
 - h) Latitude : 12°51'00"
 - i) Longitude : 78°15'30"

2. Geological set up : The old Bisanattam mine block falls in the southern extension of the Kolar schist belt which is exposed over a strike length of 16 km in Andhra Pradesh. The area consists of metamorphosed mafic and acid volcanic rocks belonging to Kolar Group of Dharwar Supergroup. These rocks are traversed by granitic rocks and pegmatite veins in the eastern part.

Mafic rocks include massive and schistose amphibolites and occasional narrow lenses of green fibrous amphibolites and chlorite schists. Acid volcanic rocks are represented by Champion gneiss and autoclastic conglomerate. Abundant thin en-echelon bands of Champion gneiss which is locally known as 'dogger' traverse the schistose amphibolite at the eastern margin in contact with the granitic rocks. The above pile of rock is intruded by dolerite, felsite and quartz veins. The strike of the formation is N-S to N30°E-S30°W with steep

westerly dips. Structurally, the area forms a synform and the central part of the synform is sheared and the maximum amount of mineralisation is found in the shear portion. The schist belt is surrounded by Peninsular Gneiss consisting of migmatites, granodiorites and tonalites. By and large the schist belt rocks are conformable to the foliation to the adjacent gneisses into which are emplaced the granitic plutons.

3. Control of mineralisation: Gold mineralisation is confined to quartz veins traversing the fissile as well as the altered amphibolites. Biotitisation is the main wall rock alteration. Pyrite and pyrrhotite are the dominant sulphides associated with minor chalcopyrite and arsenopyrite. Mineralisation is controlled by shear zones which traverse the near N-S trending regional schistosity at low angles. The mineralised zones are lensoid, parallel and 'en-echelon' in disposition and vary in width from 1 to 3 m.

4. Quantum of work done:

Detailed mapping : 0.65 sq km on 1:1000 scale

Trenching/Pitting : 70 cu m

Drilling : 2,515.20 m

The gold deposit at old Bisanattam mine block was opened by the Mysore Reef Kangundi Gold Mining Company Limited in 1893. A total of 245 kg of gold were recovered between 1894 and 1902 after crushing approximately 15,000 tonnes of ore. The South Kolar Gold Mines Limited of Bombay reopened the mine in recent years and recovered about 15 kg between 1943 and 1946 and 5 kg between 1949 and 1950. The Govardhana Gold Field Limited further developed the mine, but mining ceased in 1958 due perhaps to shortage of funds and other reasons. Just before the mine ceased operations, the company opened up an old shallow prospect shaft (New shaft) about 350 m west of the main workings.

During 1986-88, five boreholes were drilled by Geological Survey of India (GSI) at the instance of Bharat Gold Mines Limited (BGML) to intersect the mineralised zones in the unstopped portions at 150 m, 245 m and 395 m vertically below the old workings and six more boreholes were drilled with a view to find out the strike and depth persistence of the auriferous lode as also new auriferous zones, if any. Though mineralised zones were intersected in all the boreholes, excepting borehole 2 (3.2 g/t of gold over 1.2 m), all the boreholes intersected poor mineralisation.

5. Dimension of orebody : The mineralised zones are lensoid, parallel and en-echelon in disposition and extend for 300 m of which the length of the abandoned mine forms 100 m. A total of three lensoid ore bodies with a maximum strike length of 50 m with grade ranging from 1.8 to 3.2 g/t have been recognised in the area explored in between boreholes BM-7 and BM-11.
6. Gradewise Results : During the period 1884-1902 and 1943-1951, a total of 265 kg of gold was produced from the old Bisanattam mine. The mine was developed upto ten levels to a depth of 336.3 m. At the time of closure of the mine, the proved and probable ore reserve were estimated at 40,000 tonnes with a grade of 5.8 g/t of gold over a sloping width of 0.9 m. The old Bisanattam mine block is being reclaimed by MECL. A total tonnage of 1,34,876 of 5.1 g/t of gold has been established upto January 1990.
7. Ore characteristics : Free-milling type. The ore is reported to be rich in scheelite at places.
8. Recommendations : The old Bisanattam mine block lies about 5 km south of Kolar Gold Field. As the Kolar Gold field has got active mine with all infrastructure, the old Bisanattam mine block can be mined despite the block being less in reserve with an average grade of 5.1 g/t of gold.

F. Kudithanapalle Prospect

1. Location :

- a) Belt Name : Southern extension of Kolar Schist Belt
- b) Prospect/Deposit : Kudithanapalle Block
- c) Location : About 8 km south of Kolar Gold Field
- d) District : Chittoor
- e) Mandal : Kuppam
- f) Village : Kudithanapalle
- g) Toposheet : 57-L/5
- h) Latitude : 12°49'00"
- i) Longitude : 78°15'45"

2. Geological set up : Kudithanapalle block lies about 8 km south of Kolar Gold field in southern extension of Kolar schist belt which is exposed over a strike length of 16 km in Andhra Pradesh. About 1 km southeast of Bisanattam Railway Station near Kudithanapalle, a thick quartz vein is exposed in the Kolar amphibolite rocks. The reef is exposed in N-S direction over a strike length of 100 m with width ranging from 2 to 3 m. The reef was explored by an adit following the reef.

The area exposes mafic unit represented by amphibolite (both fine and coarse grained, altered and unaltered) and felsic unit represented by Champion Gneiss with bands of gabbro-anorthosite engulfed with Peninsular Gneisses.

The rocks have undergone three phases of deformation. The mineral assemblages are:

(i) diopside-hornblende-plagioclase, (ii) hornblende-plagioclase, (iii) garnet-hornblende-plagioclase-biotite, and (iv) actinolite-albite-epidote-chlorite-biotite.

3. Control of mineralisation: Gold mineralisation is hosted by both hornblende schist and Champion Gneiss. The surface manifestation of mineralisation is in the form of a prominent quartz reef which runs in N-S direction over a strike length of about 100 m with width ranging from 2 to 3 m. The reef is oxidised and carries disseminations of pyrite. The mineralised zone consists of thin veins/veinlets and stringers of quartz traversing the highly altered siliceous and micaceous hornblende schist as well as along the contact of Champion gneiss and schistose amphibolite. There are at least more than two shears of which N-S and NW-SE trending ones are prominent shears.

4. Quantum of work done:

Detailed mapping : 0.55 sq km on 1:1000 scale

Trenching/Pitting : 1,130.05 cu m

Drilling : 2,939.85 m 17 boreholes

The surface manifestations of the gold mineralisation is in the form of quartz reef. The 2 to 3 m wide reef is explored upto 100 m along the strike by an adit.

Detailed geological mapping followed by exploratory drilling was carried out by GSI during 1986-89 in Kudithanapalle block. A total of 17 boreholes completed in this block aimed at vertical intersection of depth of 40, 60, 90, 120 and 180 m helped in delineating two zones of mineralisation - the first zone occurs in quartz vein localised in sheared schistose amphibolite and the second one occurs at the contact between Champion gneiss and schistose amphibolites. The first mineralised zone with values ranging from 2.12 to 12.72 g/t over a width

of 0.22 to 1.30 m has been established over a strike length of 150 m. Molybdenum mineralisation of 0.1 to 1.2% over 0.5 to 1.00 m is associated with gold mineralisation in this zone. The second mineralised zone occurring at the contact between Champion gneiss and schistose amphibolite has been established over a strike length of 150 m based on the intersections in different boreholes at 60, 90, 120 and 180 m depth. The second mineralised zone assaying 2.6 g/t of gold over a width of 1.20 m has been encountered in borehole KP-14. This zone too contains very promising molybdenum association. The results of the drill core samples of boreholes KP-15, 16 and 17 are awaited.

5. Dimension of orebody : The reef on surface has a strike extension of about 100 m with width of 2 to 3 m. Six boreholes drilled in the quartz reef zone confirmed the depth persistence of the quartz lode upto a vertical depth of 90 m. Drilling is being carried out in the second mineralised zone occurring at the contact between the Champion Gneiss and schistose amphibolite with a view to finding out the strike and depth persistence of the mineralisation. Based on the intersections indicated by sulphide mineralisation, a zone of 150 m strike length with a width of 2 m has been deciphered upto a vertical depth of 120 m.
6. Grade wise Results : Drilling in Kudithanapalle (a total of 17 boreholes drilled) led to the establishment of two zones of mineralisation - the first one occurs in quartz vein localised in sheared schistose amphibolite and the second one occurs at the contact between Champion Gneiss and schistose amphibolite. The first mineralisation with values ranging from 2.12 to 12.72 g/t over a strike length of 150 m has been established. Molybdenum mineralisation of 0.1 to 1.2% over 0.5 to 1.00 m has been found associated with this zone. The ore reserves have not been estimated yet.

7. Ore characteristics : Biotitisation is the main wall rock alteration. Gold is found associated with molybdenum. Beside molybdenite, pyrite and pyrrhotite are the chief sulphides associated with gold mineralisation with minor chalcopyrite and arsenopyrite. The gold is of free milling type.
8. Recommendations : After establishing strike and depth persistence upto 9 m vertical depth by drilling, exploratory openings may be made in this block for better understanding of gold mineralisation, pitch and dimension of the ore shoot, along with tenor and grade of the ore at different development levels.
9. Any other information : Chigargunta which lies about 7 km south of Kudithanapalle is an active mine in the southern extension of Kolar schist belt being mined by BGML. The proximity of the prospect to working mine of K.G.F. and Chigargunta justifies development.

IV. Gadag schist belt

The northern part of the Chitradurga schist belt, north of the river Tunabhadra, is conventionally known as Gadag schist belt. The lithounits exposed are chiefly metavolcanics (greenstone and quartz porphyr) and metasedimentaries (graywacke, arenite, argillite and ferruginous chert). The above formations form a part of the Chitradurga Group of rocks. The auriferous tract kin this part of the schist belt occurs on the western limb of the overturned syncline. The auriferous tract extends over a strike length of 15 km. Boradly, the gold occurrences could be classified into three groups :

- (a) The western group comprising Hosur-Champion, Yelishirur and Venkatapur blocks.
- (b) The middle group comprising Kabuliyatkatti-Attikatti, Mysore Mine-Sangli, and
- (c) The eastern group comprising Sankatadodak block.

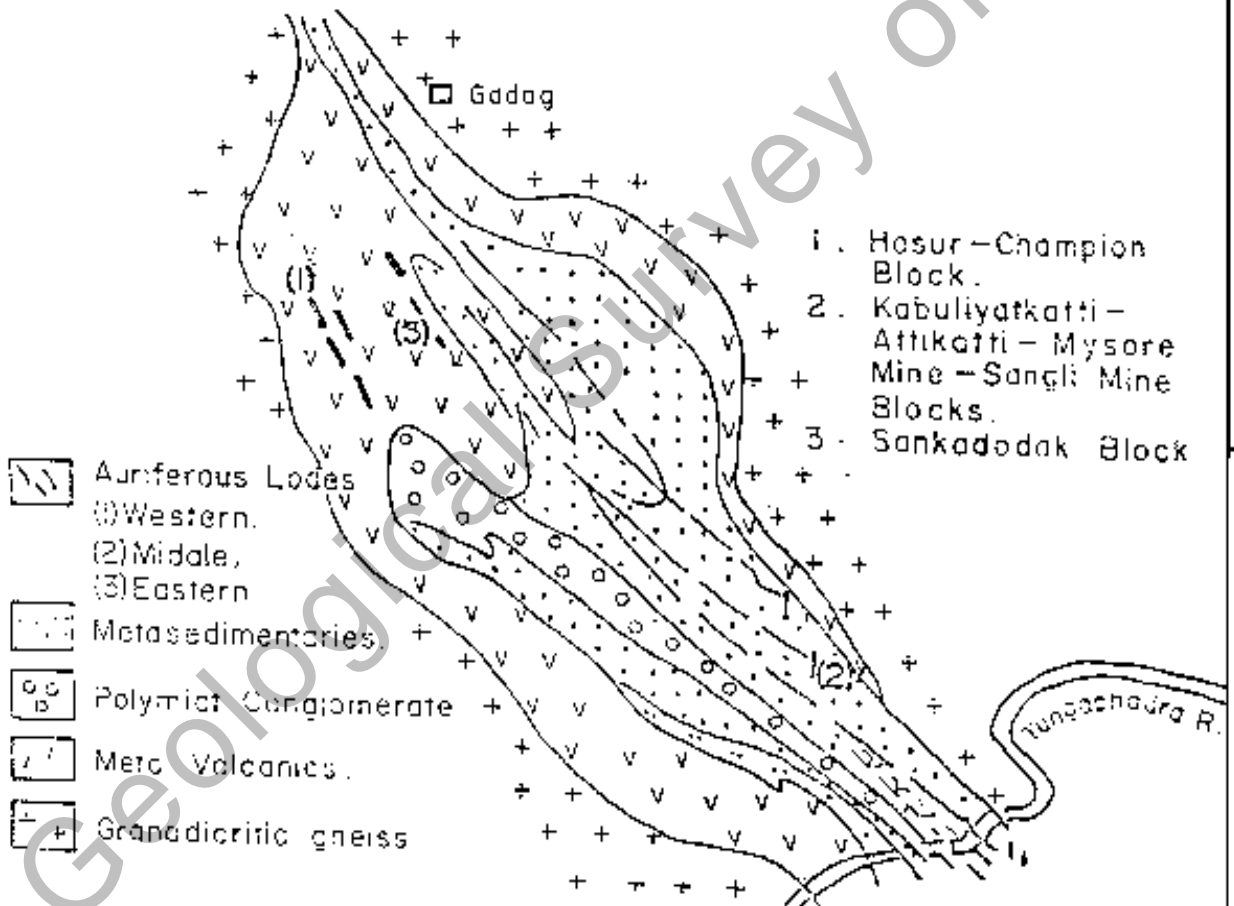
The western group is hosted dominantly by metabasalts and meta-andesites whereas the middle block is mostly confined to the metasedimentaries like graywacke. The eastern group is also hosted by the graywacke suite of rocks. In addition, gold mineralisation is also known from the area north of Nagavi within the iron formation and at the contact of the iron formation with tuffaceous rocks.

75° 10'

GENERALISED GEOLOGICAL MAP OF GADAG GOLD FIELD

0 5 10 Mrs

15°
10'



15°
10'

75° 10'

A. Hosur-Champion

1.
 - a) Belt name : Gadag Schist belt
 - b) Prospect/deposit : Hosur-Champion, Champion East, Champion West, Hosur Main
 - c) Location : Gadag
 - d) District : Dharwar
 - e) Taluk : Gadag
 - f) Village : Hosur
 - g) Latitude : 15°10' & 15°25'
 - h) Longitude : 76°25' & 76°43'
2. Geological set up : Meta volcanics (dominantly meta andesites).
3. Control of mineralisation : Mineralised zone confined to shear zone.
4. Quantum of work:
 - Detailed mapping : 5.63 sq. km. on 1:2000 scale
 - Pitting/trenching : 2958 cu. m
 - Drilling : 9084 m in 57 boreholes
 - Geochemical sampling: 1022 Nos.
 - Sampling (Core) : 2797 Nos.
5. Dimension of ore body : Hosur-Champion East 1100 m strike length. Hosur-Champion West 2240 m strike length. Two ore shoots of 100 m strike length on Champion West and the other of 400 m length on Champion East were traced up to 120 m vertical depth.

6. Grade/Reserve : Probable reserve of 0.54 million tonnes of 2.0 to 5.612 g/t over a width ranging from 1.20 to 2.33 m. was estimated by GSI.

Detailed exploration by two level old mine reclamation and deeper drilling by MECL indicated a total of 1.19 million tonnes of gold ore reserve on Hosur Champion West lode over a strike length of 1 km. upto a depth of 375 m. along plane of mineralisation with an average grade of 2.5 g/t of gold. Similar detailed exploration on Hosur Champion East lode indicated a total reserve of 0.44 million tonnes at 2.84 g/t of gold.

7. Ore Characteristics : Mineralised zones are characterised by extensive sericitisation and chloritisation with veins and veinlets of quartz and carbonates and stringers and disseminations of arsenopyrite and pyrite. Gold occurs in the native form rarely visible to the naked eye.
8. Recommendations : Holds promise for small scale mining.
9. Any other information : Experimental stoping and million has been carried out by BGML on Hosur-Champion East lode. After commissioning a small semimobile plant, the BGML treated about 3800 tonnes of ore and produced 5.5 kgs. of gold.

B. Mysore Mine

1.
 - a) Belt Name : Gadag Schist Belt
 - b) Prospect/deposit : Mysore Mine
 - c) Location : Mahalingapure
 - d) District : Dharwar
 - e) Taluk : Gadag
 - f) Village : Mahalingapure
 - g) Latitude : 15°20'
 - h) Longitude : 76°30'

2. Geological set up : Meta-volcanics and meta-sedimentaries.

3. Control of mineralisation : The mineralised zone is hosted by meta-andesite. One acid volcanic band associated with main mineralised zone is also weakly mineralised.

4. Quantum of work:

Detailed mapping	:	0.72 sq km on 1:1000 scale
Trenching	:	510 cu.m
Drilling	:	6602.45 m in 45 boreholes
Sampling	:	1790 Nos.
Geochemical sampling	:	910 Nos.

5. Dimension of ore body :

	<u>Length</u>	<u>Width</u>
East Lode	1150 m	1.00 m
Middle Lode	925 m	1.00 m
Hospital Lode	140 m	2.20 m

6. Grade/Reserve : 0.23 million tonnes of ore with grade varying from 1.17 to 4.83 g/t and width varying from 1.00 to 2.2 m. was established by GSI.

Detailed exploration through old mine reclamation and sampling at 5.00 ft interval on East lode by MECL established the continuity of mineralisation over a strike length of 492 m. and an in-situ ore potential of 90,500 tonnes with 2.72 g/t average grade was established.

7. Ore characteristics : The Middle and Hospital lodes occur in metavolcanics and is represented by chlorite schist with profuse quartz and carbonate permeations and associated pyrite and pyrohotite; sericite develop at places profusely. Mysore mine East lode occurs within meta sedimentaries represented by chlorite schist with veins, lenses and stringers of quartz carbonate and associated sulphides, sericite rarely develops.
8. Recommendations : Deserves consideration for small scale mining.
9. Any other information : Chemical and mineralogical tests on ore samples have already been conducted. Gold occurs in free state and as inclusions within pyrite and silicates. Laboratory scale beneficiation studies conducted by HGML.

C. Sangli Mine

1.
 - a) Belt name : Gadag Schist Belt
 - b) Prospect/deposit : Sangli Mine
 - c) Location : East of Mahalingeshwar Tanda
 - d) District : Dharvar
 - e) Taluk : Gadag
 - f) Village : Mahalingeshwar
 - g) Latitude : 15°18'
 - h) Longitude : 76°41'30"
2. Geological set up : Meta sedimentaries and meta volcanics.
3. Control of mineralisation : Gold mineralisation occurs in both meta sedimentaries and meta volcanics localised exclusively in three sub-parallel shear zones developed along or near the contact between the two litho units.
4. Quantum of work:

Detailed mapping	:	0.6 sq. km on 1:2000 scale
Trenching/pitting	:	3892 cu. m
Sampling	:	
Core	:	1489 Nos
Trench	:	596 Nos
Check	:	181 Nos
Composite	:	50 Nos
Drilling	:	10.485.70 m

5. Dimension of ore body : The mineralised zones established a total strike length of 2100 m for TE Lode, 820 m for NE Lode and 680 m for Main Lode.
6. Grade/Reserve : The total probable resource of 1.099 million tonnes at an average grade of 3.77 g/t. has been estimated. In addition, a total possible reserve of 0.592 m.t of ore estimated at an average grade of 1.86 g/t.
7. Ore characteristics : Characterised by intense shearing, brecciation/mylonitisation and permeation of quartz and at times carbonate veins. Disseminations and seggregation clots of sulphides are also present.
8. Recommendations : This prospect has so far indicated the best potential for gold mine development in Gadag belt.
9. Any other information : Exploration mine development by MECL is in progress and so far it has progressed upto fifth level. Mine sampling has indicated +3 g/t gold values over about 1.45 m. width in most parts. Mineralogical, chemical studies and laboratory scale beneficiation studies have already been conducted by HGML. Gravity separation and cyanidation indicated 40-48% and 94-96% gold recovery respectively.

V. Chitradurga schist belt

The Chitradurga schist belt extends over a strike length of about 460 km from Gadag in the north to Srirangapatnam in the south. The lithounits of this schist belt comprise metavolcanic rocks- both metabasalts and meta acid volcanics and metasedimentaries comprising graywacke-argillite suite of rocks and banded iron formation. There is a well known sulphide belt extending from Yerahalli in the south to Honnemaradi in the north over a strike length of 40 km hosting sulphides like pyrite, pyrrhotite, arsenopyrite, chalcopyrite, galena, sphalerite, etc. Parallel to this sulphide belt and sometimes closely intermixed with this sulphide belt gold mineralisation is also encountered. In this sulphide belt considerable silver mineralisation is also noticed. Geologically, this mineralisation simulates mesothermal type of copper-silver-gold-lead-zinc deposit. At present, exploration for gold in this schist belt is in progress in the G.R. Halli-C.K. Halli and Honnemaradi area. In addition, further investigation is in progress in Ajjanahalli and Bellara areas. The details of the above prospects are furnished in a tabular format.

A. Ajjanahalli

1.
 - a) Belt name : Chitradurga Schist Belt
 - b) Prospect/deposit : Ajjanahalli
 - c) Location : Northern flank of Gavigudda hill
 - d) District : Tumkur
 - e) Taluk : Sira
 - f) Village : Ajjanahalli
 - g) Latitude : 13°45'00"
 - h) Longitude : 76°44'00"

2. Geological set up : The rock types met with are meta-volcanics and meta-sedimentaries, banded iron formation having oxide, carbonate and sulphide facies.

3. Control of mineralisation : Gold mineralisation is shear controlled and the shears are post F_2 deformation. It is seen in BIF and argillite suite of rocks.

4. Quantum of work:
 - Detailed mapping : 1.66 sq.km on 1:1000 scale
 - Trenching : 2563 cu. m
 - Drilling : 6640.70 m
 - Sampling : 5536 Nos

5. Dimension of ore body : The mineralised zones 1,3,4 and 5 have been established over a strike length of 800 m, 250 m, 250 m and 350 m respectively by drilling and Zone-6 has been established over a strike length of 800 m by trenching.

6. Grade/Reserve : A probable reserve of 0.677 million tonnes ore with an average grade of 2.77 g/t over 7.51 m average width for Zone-3,4 and 5 has been computed.
7. Ore characteristics : Gold mineralisation is in association with quartz-carbonate veins emplaced along shear zones in the banded iron formation (BIF) of sulphide facies in association with quartz-chlorite schist, meta-andesite and agillite-greywacke with sulphides.
8. Recommendations : A small scale open cast mine may be possible upto the depth of 100 m. from top of the hill.
9. Any other information : Laboratory scale beneficiation studies have been conducted on a bulk sample drawn from ground level of the prospect. The average grade of the sample treated was 4 g/t gold and 92% recovery was achieved by cyanidation (HGML).

B. Bellara

1.
 - a) Belt name : Chitradurga schist belt
 - b) Prospect/deposit : Bellara
 - c) Location : Bellara
 - d) District : Tumkur
 - e) Taluk : Sira
 - f) Village : Bellara
 - g) Latitude : 13°35'00"
 - h) Longitude : 76°35'00"

2. Geological set up : The area is made up of basic meta volcanics and meta sedimentary rocks.

3. Control of mineralisation : Mineralised zones are confined to shear zones in meta volcanic and meta sedimentary rocks.

4. Quantum of work
 - Detailed mapping : 1.00 sq. km. on 1:1000 scale
 - Trenching : 673 cu.m
 - Sampling : 679 Nos
 - Regional Geochemical mapping : 60 sq. km on 1:25,000 scale

5. Dimension of ore body : Two mineralised zones with 600 m and 135 m strike lengths have been reported.

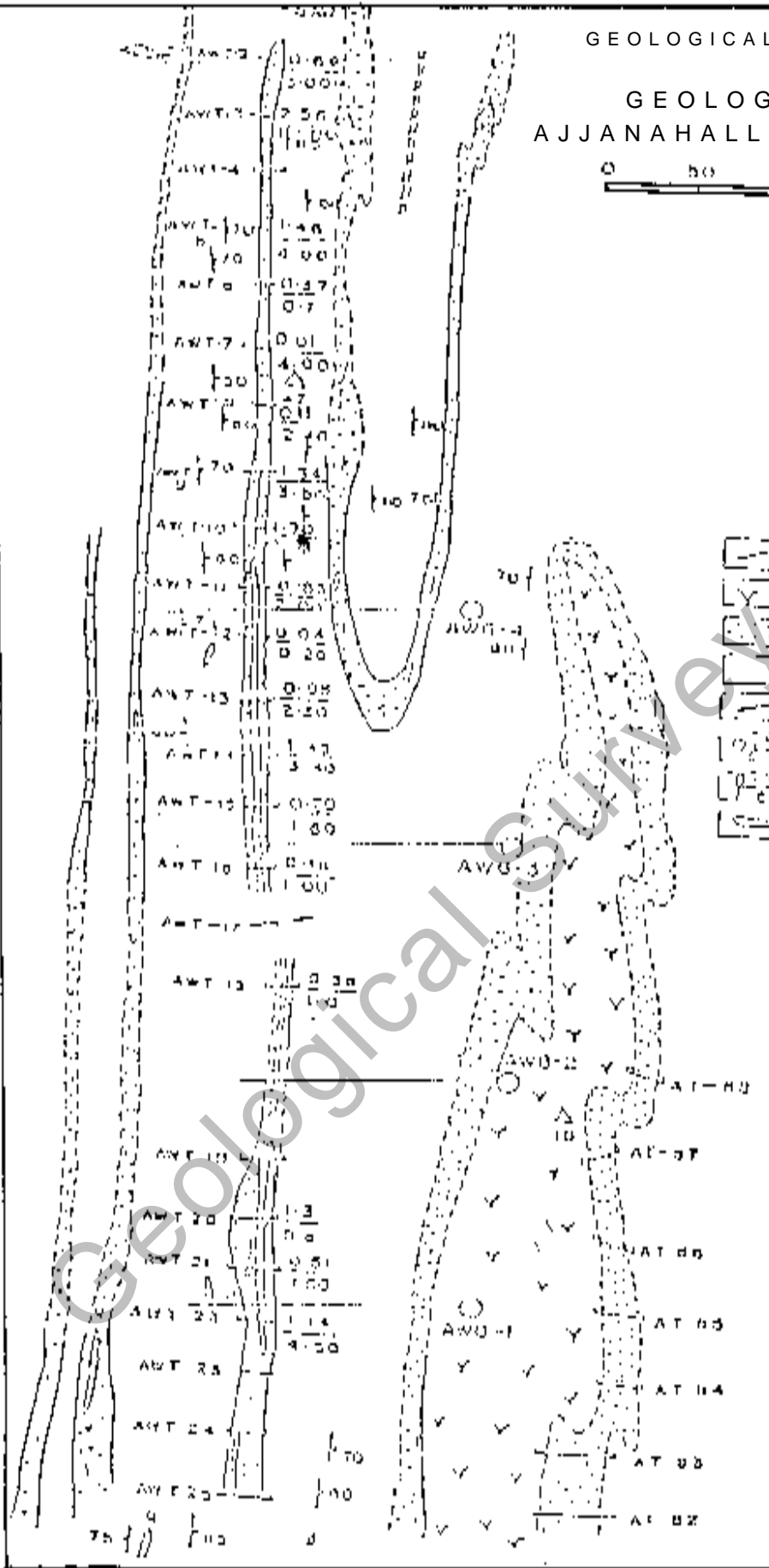
GEOLOGICAL SURVEY OF INDIA

GEOLOGICAL MAP OF
AJJANAHALLI WESTERN BLOCK



I N D E X

- Quartz vein
- Argillite/argyranocke
- BIF
- Meta volcanic rock
- Trench with number
- Barrenite location
- Gold value over true width
- Mineralised zone



6. Grade/Reserve : A reserve of 0.2 to 0.25 million tonnes upto a depth of 304 m has been estimated (by State Govt of Karnataka).
7. Ore characteristics : The mineralised zone is characterised by quartz vein containing minor amount of sulphides.
8. Recommendations : Blocked out reserves of 50,000 tonnes at 3.5 g/t is left unmined in the mine. Detailed work is essential to arrive at definite conclusions.

C. G. R. Halli

1.
 - a) Belt Name : Chitradurga schist belt
 - b) Prospect/deposit : G.R. Halli
 - c) Location : G.R. Halli
 - d) District : Chitradurga
 - e) Taluk : Chitradurga
 - f) Village : G.R. Halli
 - g) Latitude : 14°17'00"
 - h) Longitude : 76°24'00"
2. Geological set up : The main rock types are meta-basalts and carbonaceous argillite/greywacke.
3. Control of mineralisation : Auriferous quartz veins within the sheared and chloritised meta-basalt and carbonaceous argillite-greywacke.
4. Quantum of work :

Large scale mapping	:	54 sq. km on 1:12,500 scale
Detailed mapping	:	0.94 sq. km on 1:1000 scale
Trenching	:	1377 cu.m
Sampling	:	3879 Nos
		737 Nos (Core)
Drilling	:	1311.00m

5. Dimension of ore body : (i) Two auriferous quartz veins 510 m and 260 m strike length were traced.
- (ii) Drilling indicated a zone of 332 m strike length.
6. Grade/Reserve : Grade 6.06 g/t over 0.67 m width.
7. Ore characteristics : Gold associated with sulphides.
8. Recommendations : This prospect forms a part of the sulphide belt hosting Cu, Pb, Zn, Au and Tungsten.

Geological Survey of India

VI. SHIMOGA SCHIST BELT

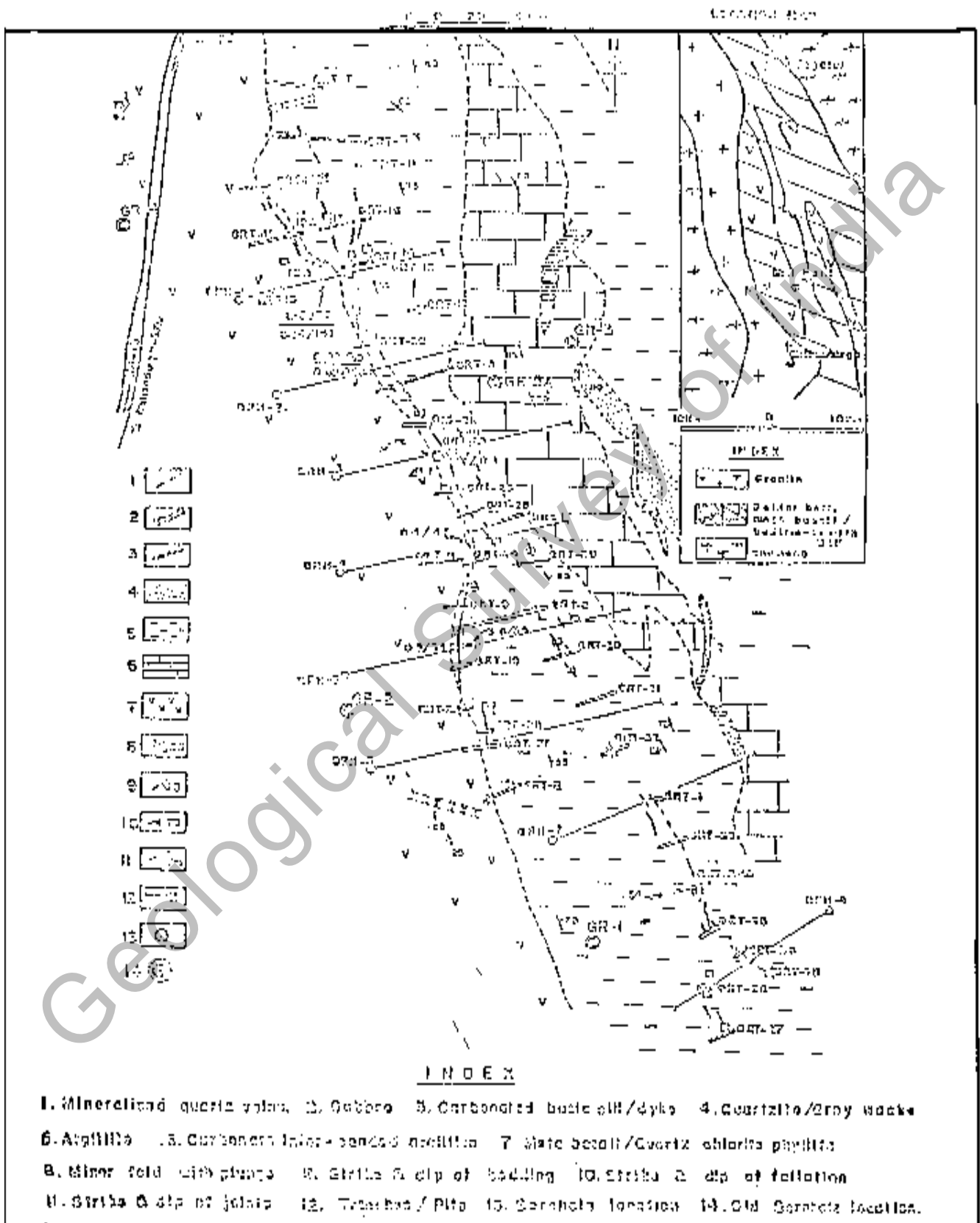
This is an arcuate to equant belt of sediment dominated type and covers an area of 22,500 sq.km. It extends in a north-north-westerly direction for a length of 250 km and has a maximum width of 120 km. The western margin of the basin is marked by large domal masses of basement gneiss which occur as islands surrounded by platformal sediments and volcanics. Broadly from west to east, the basal sequence comprises orthoquartzite and metabasalt progressively overlain by metagreywacke/argillite, calcareous/manganiferous/ferruginous sediments and these in turn give way further east to an upper sequence of extensive metagreywacke-argillite with minor volcanics. The rocks were metamorphosed to low grade greenschist facies and exhibit three phases of folding. The basal trondhjemite gneisses yielded whole- rock isochron age of 3400 m.y. Intrusive granitic plutons were dated around 2600 m.y. and these were emplaced towards the closing stages of orogeny.

Gold mineralisation is rather sparsely known from the vast volcano-sedimentary package. Gold was won from Honnali Gold Field in late nineteenth century from narrow quartz reef (1 to 5 m wide) with gold tenor of 6.2 g/t on an average. Mineralisation is confined to basic volcanic rocks of the basal platformal quartzite-conglomerate sequence. Broadly gold mineralisation of the following two types have been noticed in the belt.

- (1) Narrow gold-quartz veins in basic volcanics and ultramafic host rock of the lower stratigraphic sequence. The veins are narrow and are strongly structurally-controlled. Examples include - Honnali Gold Field, Jalagar-gundi, Siddarahalli etc.
- (2) Gold mineralisation in sulphidic BIF in greywacke-argillite of the upper sedimentary sequence viz. Chinmulgund, Haveri etc.

GEOLOGICAL SURVEY OF INDIA

GEOLOGICAL MAP OF G. R. HALLI, CENTRAL BLOCK



A. Chinmulgund

1.
 - a) Belt name : Shimoga schist belt
 - b) Prospect/deposit : Chinmulgund
 - c) Location : Chinmulgund
 - d) District : Dharwar
 - e) Taluk : Haveri
 - f) Village : Chinmulgund
 - g) Latitude : 14°35'00"
 - h) Longitude : 75°24'00"

2. Geological set up : Precambrian meta-sedimentary rocks of Shimoga schist belt.

3. Control of mineralisation : Banded magnetite quartzites form the host for mineralisation and favourable conditions in the sulphide rich, fractured and silicified zones of partings of schist/ tuff within and adjoining it.

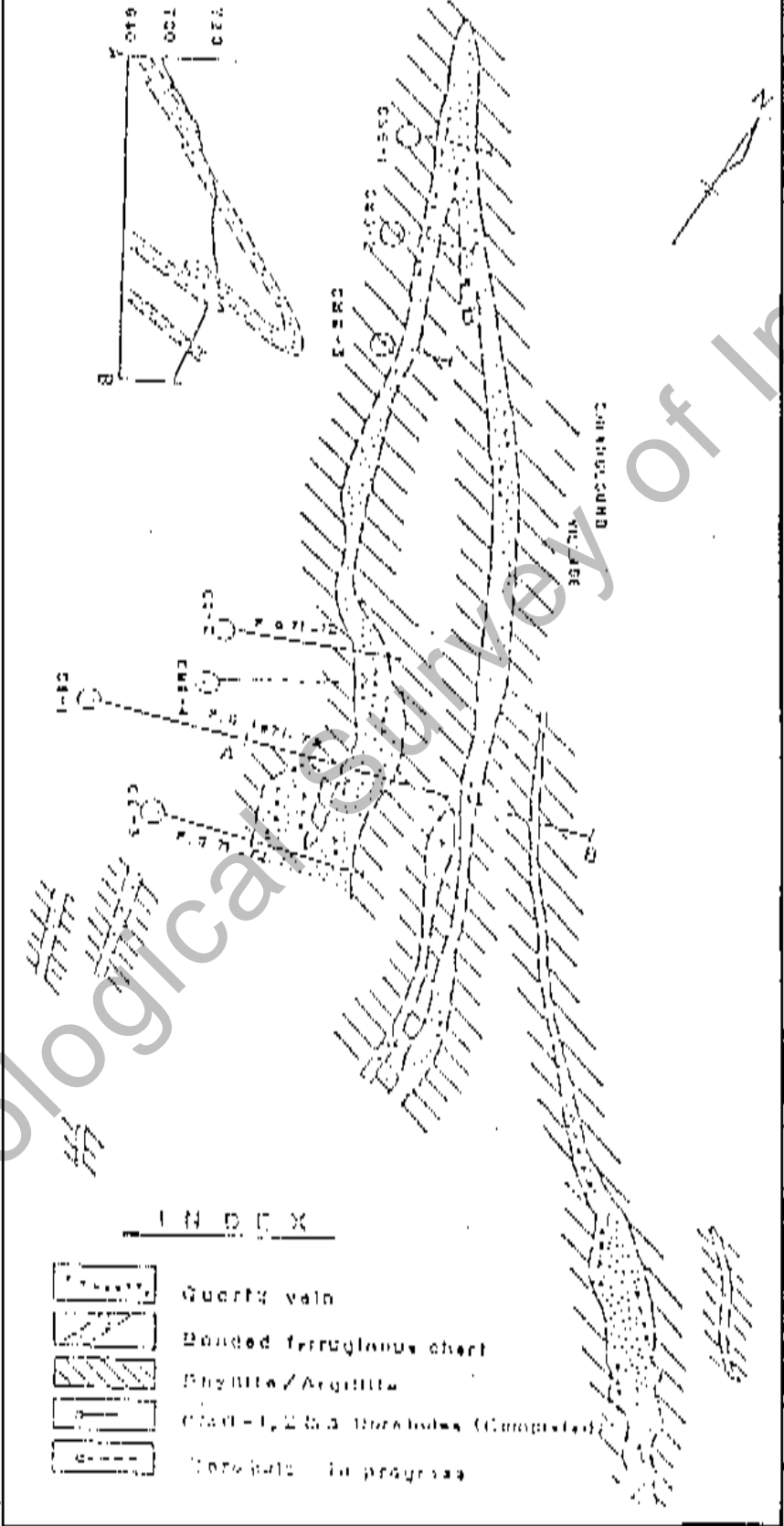
4. Quantum of work :
 - Mapping : 0.5 sq km on 1:2000 scale
 - Trenching : 625 cu.m
 - Sampling : 2322 Nos
 - Drilling : 15773.70 m

5. Dimension of ore body : Surface sampling indicates that auriferous zones are of 100 to 200 m length and 2 to 5 m width.


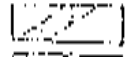
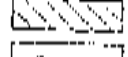
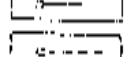

6. Grade / Reserve : Sampling has indicated an average grade of 2 to 4 g/t.
7. Ore characteristics : Surface samples consist of oxides and free grains of gold.
8. Recommendations : The possibility of low grade large tonnage gold deposit associated with BIF further southwards seems to be very encouraging.
9. Any other information : Preliminary beneficiation studies of surface samples have already been carried out by Indian Bureau of Mines (IBM). Straight cyanidation indicated 98% recovery of gold.

GEOLOGICAL SURVEY OF INDIA
 GEOLOGICAL MAP OF CHINMULGUND AREA,
 DHARWAR DISTRICT, KARNATAKA

1:50,000



I N D E X

-  Quartz vein
-  Banded ferruginous chert
-  Shalyite / Argillite
-  Grid - 1, 2 & 3 boreholes (Completed)
-  Borehole - in progress

VII. NUGGIHALLI BELT

An ultramafic complex with abundant chromite 'reefs' in serpentinite and vanadiferous titanomagnetite seams in gabbroic amphibolites is exposed through the entire length of Nuggihalli belt. Chromite with 20-25% Cr₂O₃ is being mined in Byrapur and extensions, and is exported to Japan. The titanomagnetite bodies have also been explored for vanadium and titanium. These bodies together with their associated gabbros have been explored by drilling for copper sulphides, which indicated a copper deposit of low grade (Av.0.3% with a range from 0.1 to 1.7% Cu). Reconnaissance studies for platinoids have yielded the following values: Pt 15-25 ppb, Pd 35-45 ppb and Ir & Re 2 ppb. Large scale mapping, systematic sampling and accurate chemical analysis are required to assess the PGE potential of this belt.

Regional geochemical surveys in parts of the belt and airborne multi-sensor surveys have not given clues to any rich metallic deposits in the belt. However, the bifurcating arm of this belt called Aladahalli belt (Gandashi band) was found to contain pyritiferous lodes on the basis of aeromagnetic surveys and surface examination of gossan. Detailed investigations by drilling have yielded only a marginal deposit of copper in the belt. Further drilling investigations in the extensions of the newly discovered sulphide belt did not give encouraging results.

The southern extremity of the Nuggihalli belt in Kempinkote has been examined in detail in recent years for gold. Quartz lodes in ultramafic rocks and possible lamprophyres have only indicated low grade gold deposits in the belt. Old workings for gold exist in Gollarahalli and Yelwari in the northern parts of the belt. In view of the extensive surveys already conducted in recent years, this belt may be taken up for detailed studies without assigning any priority in the coming years.

A. Kempinkote

1.
 - a) Belt name : Nuggihalli schist belt
 - b) Prospect/deposit : Kempinkote
 - c) Location : 20 km East of Channarayapatna
 - d) District : Hassan
 - e) Taluk : Channarayapatna
 - f) Village : Mattanvile
 - g) Latitude : 12°54'00"
 - h) Longitude : 76°31'00"

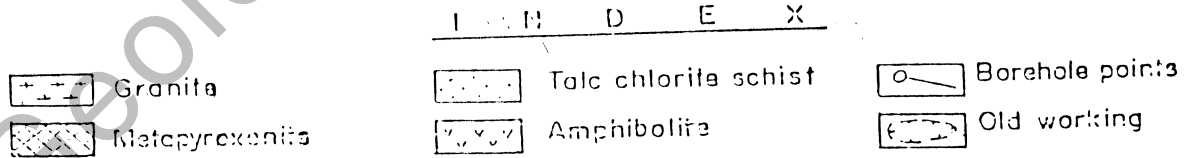
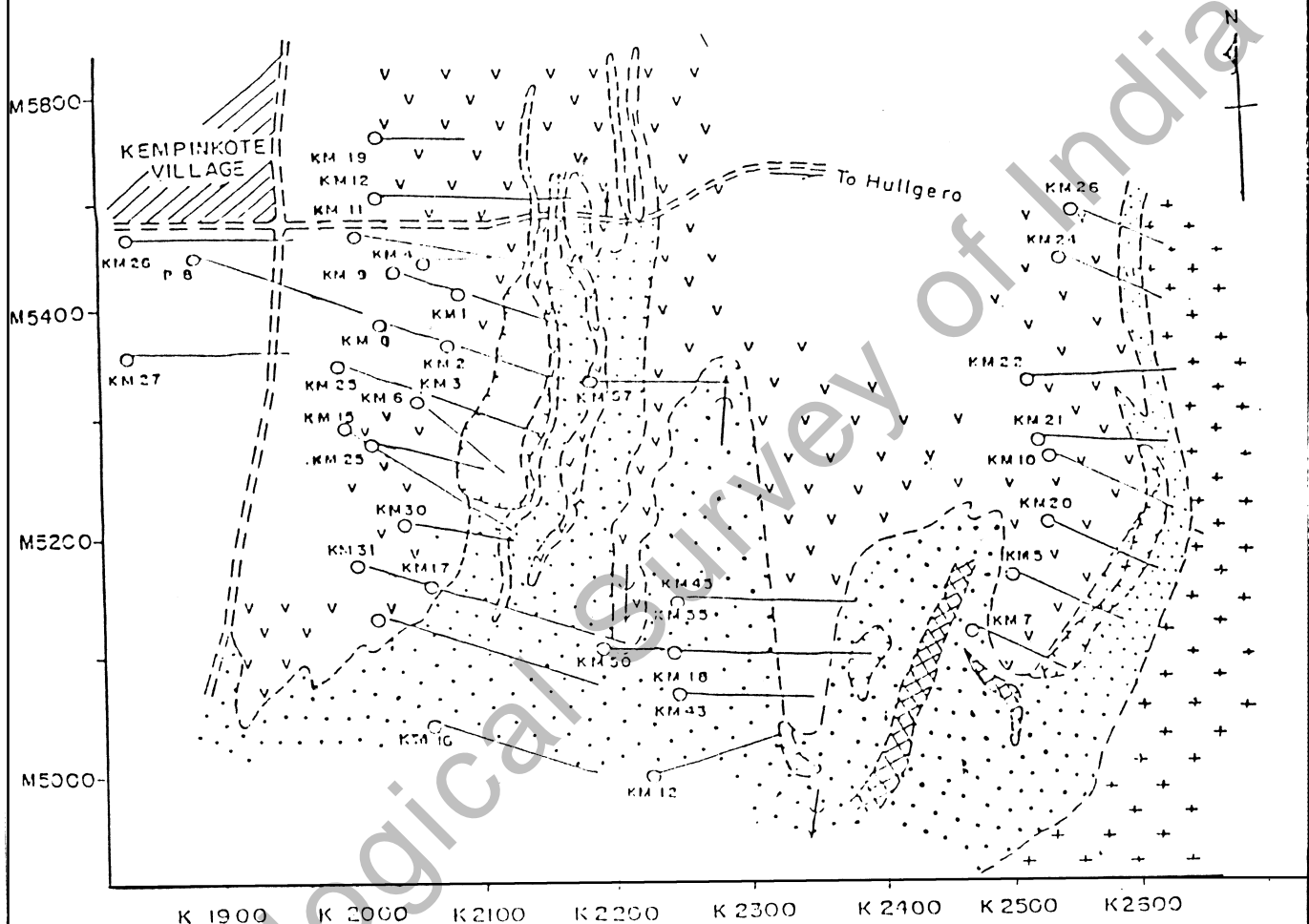
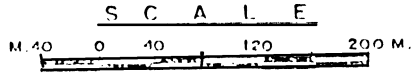
2. Geological set up : The area is comprised of ultramafic and mafic flows with minor sedimentary units.

3. Control of mineralisation : Gold mineralisation is at the contact of ultramafic and mafic flows - silicification - pyrite, arsenopyrite, free gold.

4. Quantum of work :
 - Detailed mapping : 2.87 sq.km on 1:2000 scale
 - Pitting & Trenching : 4866 Cu.m
 - Drilling : 10,019.70 m
 - Sampling : 8665 Nos.

5. Dimension of ore body : Three zones over a cumulative strike length of about 1 km (West zone 450 m, Middle zone 200 m and Eastern zone 350 m).

INVESTIGATION FOR GOLD IN KEMPINKOTE-NUGGIHALLI SCHIST BELT
 HASSAN DISTRICT : GEOLOGICAL MAP OF KEMPINKOTE SOUTH BLOCK.



6. Grade / Reserve : A total resource of 3.5 million tonnes with an average grade of 1.225 g/t over a true width of 49.92 m. has been estimated.
7. Ore characteristics : Free-milling type
8. Recommendations : One deep borehole upto 300 m vertical depth has indicated continuity of host rock thus trebling the resources to 10.5 million tonnes of low grade.

2.3 A summarised account of gold potentiality of individual blocks of the greenstone belts

Sl. No.	Name of the belt with status of gold mining	Exploration Result in blocks outside present mine limits			Remarks
		Name of the block	Ore tonnage Established by GSI	Gold Grade	
1.	I. Hutti-Maski (Hutti block is under current mining)	A. Uti	0.884 m.t.	2.04-18.98g/t	More resources likely
		B. Uti Temple	—	—	Under assessment
		C. Tuppadhur	0.089 m.t.	3.95 g/t	
		D. Wandalli	0.650 m.t.	4.00 g/t	
		E. Chinchergji	0.060 m.t.	5.00 g/t	
		F. Kadoni	0.064 m.t.	4.00 g/t	
		G. Buddini (MECL)	0.210 m.t.	2.16 g/t	
		H. Sanbal	—	—	Not assessed
(SUBTOTAL)		1.957 m.t.	3.83 g/t		
2.	II. Ramagiri (Yeppanana block is currently under mining)	A. Ramapuram	0.075 m.t.	6.24 g/t I	
		B. Bhadrampalle	0.060 m.t.	3.03 g/t I	
		C. Kottapalle	0.033 m.t.	3.29 g/t I	
		D. Chinnabhavi	—	—	Under assessment
		E. Penakacherla -Kuderu	—	—	-do-
		F. Penukonda	—	—	-do-
		(SUBTOTAL)		0.144 m.t.	4.60 g/t I

3.	III. Kolar (K.G.F. and three blocks in Chigarguntu are under mining)	A. Surapalle	0.114 m.t.	5.00 g/t	
		B. Chigargunta Block-IV (West)	0.600 m.t.	3.34 g/t	
		C. Chigargunta North of Block-I	0.030 m.t.	12.34 g/t	
		D. Mallappakonda	0.773 m.t.	2.50 g/t	
		E. Old Bisanattam	0.134 m.t.	5.10 g/t	
		F. Kudithanapalle	—	—	Under assessment
(SUBTOTAL)			1.651 m.t.	3.40 g/t	
4.	IV. Gadag (Abandoned gold mines)	A. Hosur-Champion	1.630 m.t.	2.60 g/t	Combined GSI/MECL estimate
		B. Mysore Mine	0.230 m.t.	3.00 g/t	
		C. Sangli	1.099 m.t.	3.77 g/t	
(SUBTOTAL)			2.959 m.t.	3.50 g/t	
5.	V. Chitradurga (Abandoned gold mines)	A. Ajjanahalli	0.677 m.t.	2.77 g/t	
		B. Bellara	0.250 m.t.	3.50 g/t	
		C. G. R. Halli	—	—	Not assessed
(SUBTOTAL)			0.927 m.t.		
6.	VI. Shimoga (Abandoned gold mines)	A. Chinmulgund	—	—	Under assessment
7.	VII. Nuggihalli (Abandoned gold mines)	A. Kempinkote	3.500 m.t.	1.22 g/t	

3.0 CONCLUDING REMARKS

3.0 In the recent past exploration for gold in India commenced during 1956 with a low key with emphasis on the Kolar Gold Fields (K.G.F.). Similar activities were continued in Ramagiri and Gadag Gold Fields. Geological Survey of India has been the principal and sole agency for carrying out exploration for gold till early seventies. At this juncture real impetus to explore additional targets were initiated. All the old gold occurrences, prospects and abandoned prospects were documented. Systematic geological evaluation and integrated follow-up exploration were carried out in many areas during the last one and half decade. Mineral Exploration Corporation Limited, another national agency, stepped into gold exploration in late seventies for carrying out detailed exploration in the blocks recommended by GSI. The exploration data generated from time to time were regularly reviewed and programmes were revised/reoriented accordingly taking into account the latest concepts of gold metallogeny. Considerable advancement in techniques of exploration such as airborne multisensor survey, geochemical survey, instrumentation in speedy analysis of samples etc. were also utilised. Implementation of these programmes resulted in a fair degree of success. However, there are definite fields of weaknesses also.

3.1 There are about 12 greenstone belts in the western block and about 14 detached greenstone belts in the eastern block of Dharwar craton falling in the states of Karnataka and Andhra Pradesh. Basic geological data pertaining to most of the schist belts are available with the Geological Survey of India. Exploration for gold was focussed in seven most important auriferous belts namely, Hutti-Maski, Ramagiri, Penakacherla, Kolar, Gadag, Chitradurga, Shimoga and Nuggihalli. These activities led to the identification of 28 blocks which deserve further attention for advanced exploration and/or exploitation depending on individual merit. Exploration is still in progress in many of the blocks within the seven identified belts under first category. Such a prioritisation was conceived for two important reasons, i.e. the proximity of the occurrences/prospects to the working gold mines and the better probability of locating new prospects in the vicinity of old/abandoned mines. Thus, known ore environment was given preference. Besides, exploration efforts have also been diverted to various other belts such as Sandur, Hungund, Kadiri, Velligallu, Raichur, Gadwal, Jonnagiri, Pseddavaru, etc. which are geologically quite potential and favourable indications of gold mineralisation have been obtained from many areas.

3.2 Twenty of the prospects explored are located in three major mining districts like Kolar, Hutti and Ramagiri. These are mostly vein-type deposits, narrow in width and low in grade. Only in few prospects, there is possibility of winning high

grade ores in small patches exists. In Uti block, Hutti-Muski belt, recent exploratory mine development by MECL as a follow-up of G.S.I, investigation has raised the hopes for a low grade-medium tonnage open-pittable gold mining proposition. However, on the whole, most of the prospects appear as low grade and low tonnage type which may become amenable for small-scale gold mining. All these small prospects of marginal to sub-economic grade surround the large deposits of Kolar, Hutti and Ramagiri. Quantitative grade- tonnage modelling of resource data has indicated the possibility for discovery of gold prospects particularly of medium tonnage range in Dharwar craton. The present tonnage estimate are, however, constrained by the limited depth of subsurface exploration when it is well known that Archaean lode-gold deposits possess great depth extensions (1 to 3 Km).

3.3 Apart from the vein-type prospects, gold mineralisation of possible economic significance in Banded Iron Formation (BIF) of sulphide and oxide facies has come to light in three localities i.e. Mallappakonda (Kolar belt), Ajjanahalli (Chitradurga belt) and Chinmulgund (Shinogabelt). These prospects deposits bearing some commonalities in mode of occurrence and nature of mineralisation, exhibit quite diverse lithological association and tectonic setting. These have opened up scope for search of gold mineralisation in BIF which is obiquitous in all schist belts of Dharwar craton. Mineralisation in BIF may be amenable for low grade open-pit mining in view of the large alteration haloes, tectonic thickening and surficial enrichment due to oxidation.

3.4 Disseminated mineralisation constitutes the third type and only two such prospects have been brought to light in recent exploration. In Uti prospect, Hutti-Muski belt and Kempinkote prospect, Nuggihalli belt, gold mineralisation between 1 and 3 g/t average grade over 20 m average width have been indicated.

4.0 RECOMMENDATIONS

Based on the available data in totality, the following recommendations are presented with the objective of, (i) immediate augmentation of gold production in the country, (ii) prioritising areas/blocks for immediate attention, (iii) development of stratabound-type prospects and (iv) transfer of technology for the development of indigenous skill and know-how in exploration for gold and its development.

4.1 DEVELOPMENT OF NEW GOLD MINES

Preliminary to detailed exploration have been completed in most of the 28 blocks occurring in seven schist belts of Karnataka and Andhra Pradesh. Many of these may merit development and possibly can be converted into deposits.

4.2 PRIORITISATION OF BLOCKS FOR DEVELOPMENT

In order to expedite the development of new gold mines, a scheme of prioritisation of the blocks will be a prerequisite for optimising resource utilisation. On the basis of the strength and intensity of current exploration data, size of the prospect and ore potential and proximity to operating gold mines, the various blocks are tentatively prioritised into 3 categories.

Priority - 1		Total
<i>Hutti-Maski belt</i>	– Uti block, Uti Temple, Tuppadhur, Buddini, Wandalli	5
<i>Kolar belt</i>	– Surapalle, Chigargunta block-IV(W), Chigargunta North of block-I, Mallappakonda, Old Bisanattam	5
<i>Gadag belt</i>	– Sangli, Hosur-Champion, Mysore	3
		Sub Total - 13
Priority - 2		
<i>Ramagiri belt</i>	– Kottapalle, Chinnabhavi	2
<i>Hutti-Maski belt</i>	– Kadoni, Chinchergi, Sanbal	3
<i>Kolar belt</i>	– Kudithanapalle	1
<i>Chitrodurga belt</i>	– Ajjanahalli, Bellara, G.R. Halli	3
<i>Nuggihalli belt</i>	– Kempinkote	1
		Sub Total - 10
Priority - 3		
<i>Ramagiri belt</i>	– Bhadrampalle, Ramapuram, Penakacherla-Kuderu, Penukonda	4
<i>Shimoga belt</i>	– Chinmulgund	1
		Sub Total - 5
		Grand Total - 28

4.3 DEVELOPMENT OF STRATABOUND-TYPE PROSPECTS

The BIF hosted prospects need special attention for exploration/development. Large width and low grade of mineralisation have been indicated at the surface level in some of the prospects. Possibility of bulk mining by open cast method should be explored. Similar attention should be paid to some of the disseminated type gold prospects.

4.4 TECHNOLOGY TRANSFER

In Dharwarian schist belts of South India, there are a number of small vein-type gold prospects which call for improved methods of narrow vein mining for their economic exploitation. Also there are some near-surface, wide, low-grade gold prospects. To achieve these goals, technology transfer in the following fields are suggested.

- (i) Small-scale mining, milling and modern metallurgical treatment plants to suit the type of gold prospects available in South India.
- (ii) Introduction of cluster mining and mobile mining machineries in areas having less infrastructural facilities.
- (iii) Exploration of quarriable low grade, oxidised gold ores by suitable mechanised mining, milling and metallurgical treatment.