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# UNLOCKING INDIA'S MINERAL WEALTH

## Geological Survey of India (GSI)



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## INDIA – EXPLORATION & MINING MISSION

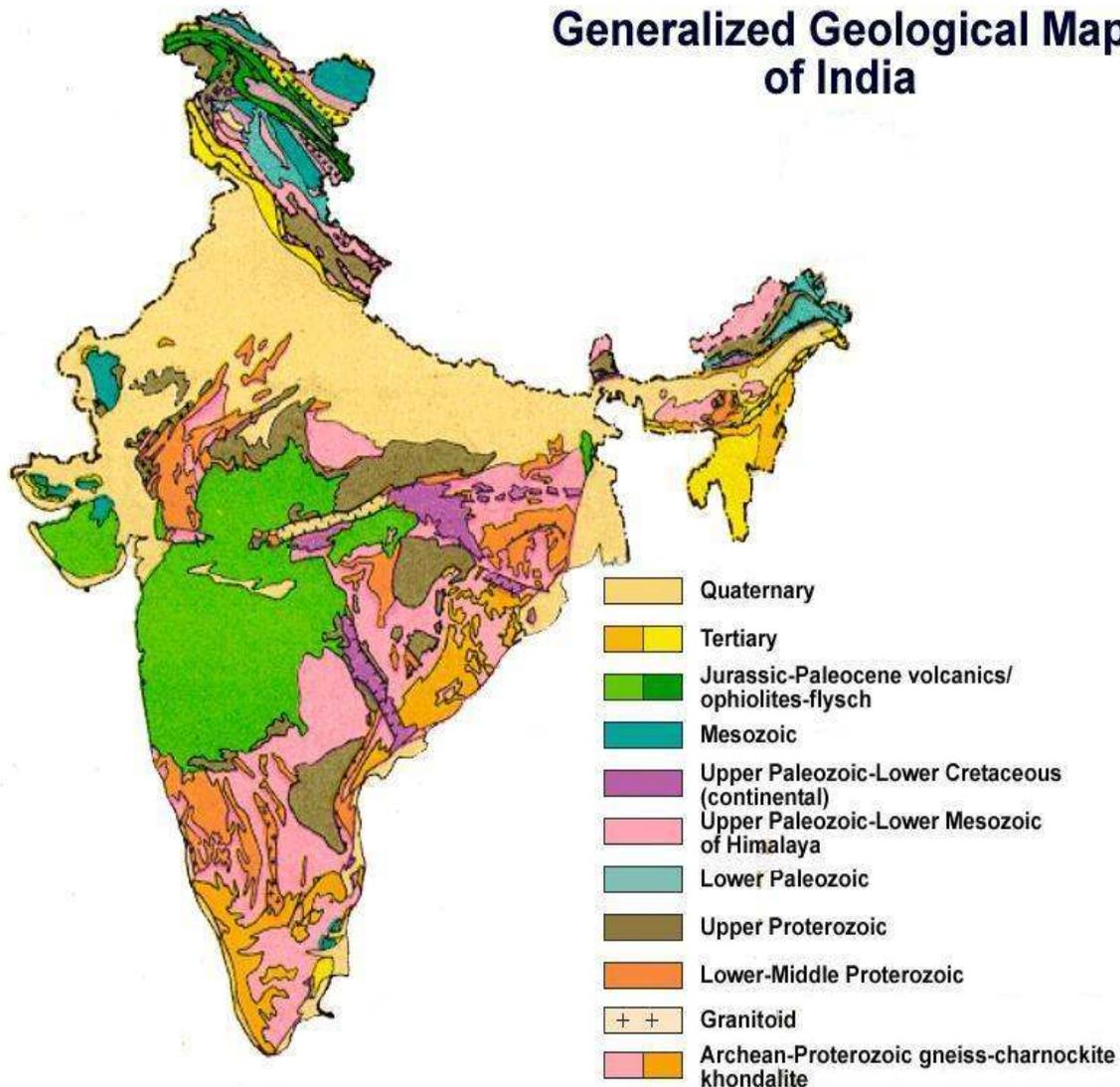
- **India has similar and comparable geological domains as in Canada -well endowed with mineral resources which is yet to be fully explored, assessed and exploited.**
- **Reliable Geological Data.**
- **Favourable Mineral Policy.**



## INDIA – EXPLORATION & MINING MISSION

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Generalized Geological Map of India



- Geomorphologically is divided into three parts:
  - ❖ Peninsular India
  - ❖ Extra Peninsular and
  - ❖ Indo-gangetic Brahmaputra Alluvium
- Exposes rock units from Archaean metamorphites/granitoids to the youngest Quaternary alluvium.
- Geological and metallogenic history similar to mineral rich shield area of Antarctica, Australia, South Africa and South America.
- Is the main repository of economic minerals



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Total Land Area: 3.28 m.Sq.Km

Hard Rock: 2.386 m.Sq.Km

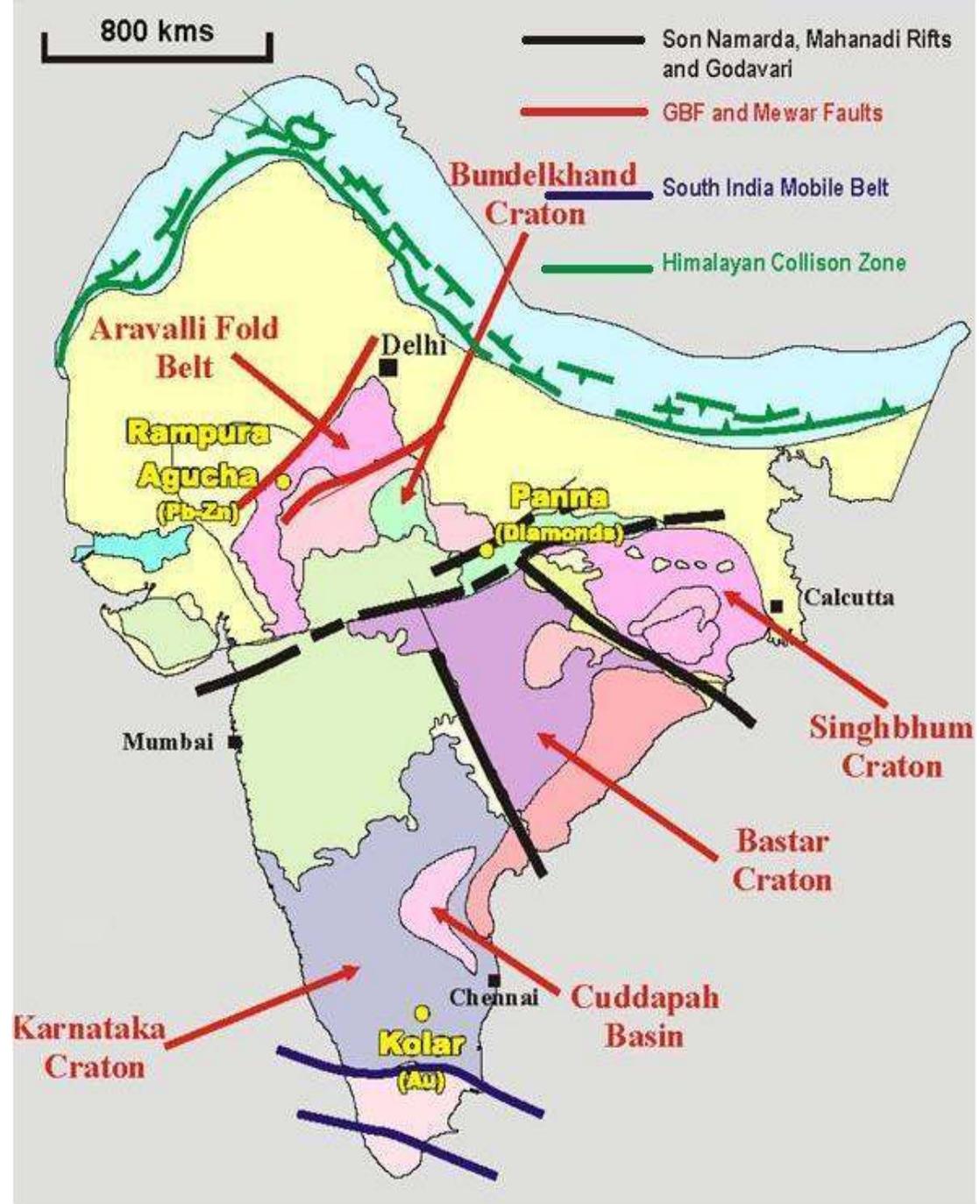
Alluvial Cover : 0.894 m.Sq.Km

98.23% mapped in 1:50,000/ 63,360 scale

96% Exclusive Economic Zone mapped

0.42 million sq km Multisensor aerogeophysical survey

1.63 million sq km aero magnetic survey





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## **INDIA – EXPLORATION & MINING MISSION**

### **MINERAL POTENTIAL AREA**

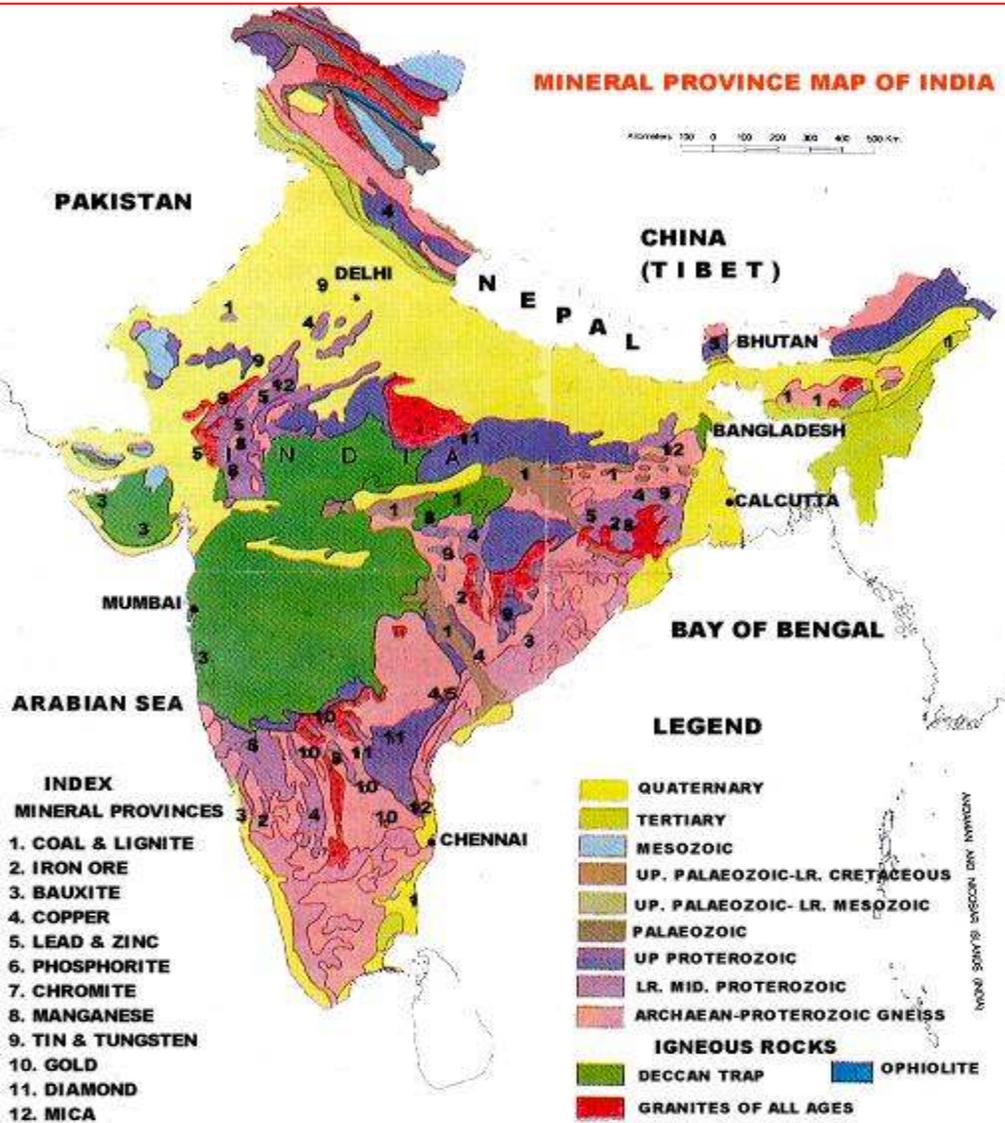
- **1,02,809 sq km for gold**
- **3,00,000 sq km for diamond and precious stone**
- **1,81 150 sq km for base metal**
- **8,130 sq km for platinum group of elements**
- **5,135 sq km for iron ore**
- **4,600 sq km for manganese ore**
- **2,690 sq km for chromite**
- **6,000 sq km for manganese**
- **1,300 sq km for tin & tungsten and**
- **32,520 sq km for bauxite.**

**Around 150 mineral belts with potential mineral zones / deposits have been identified till date within OGP domain.**

## Mineral Province map of India



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### Archaean – Proterozoic

- ◆ **Cu, Pb, Zn, Fe, Mn, Au, W, U, Mo in volcano-sedimentary sequences**
- ◆ **Fe, Mn, Mg, Base metals, phosphorite in sedimentary environment**
- ◆ **PGE, Cr, Ni, diamond in ultramafic rocks**
- ◆ **Base metals, Au, Mo associated with acid-intermediate magmatism**
- ◆ **Sn, W, mica, rare metals related to late hydrothermal / pneumatolytic processes**

## BASE METAL



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➤ **Deficient.** Total resource of copper ore 1.39 billion tonnes and of lead- zinc ore 522.58 million tonnes.

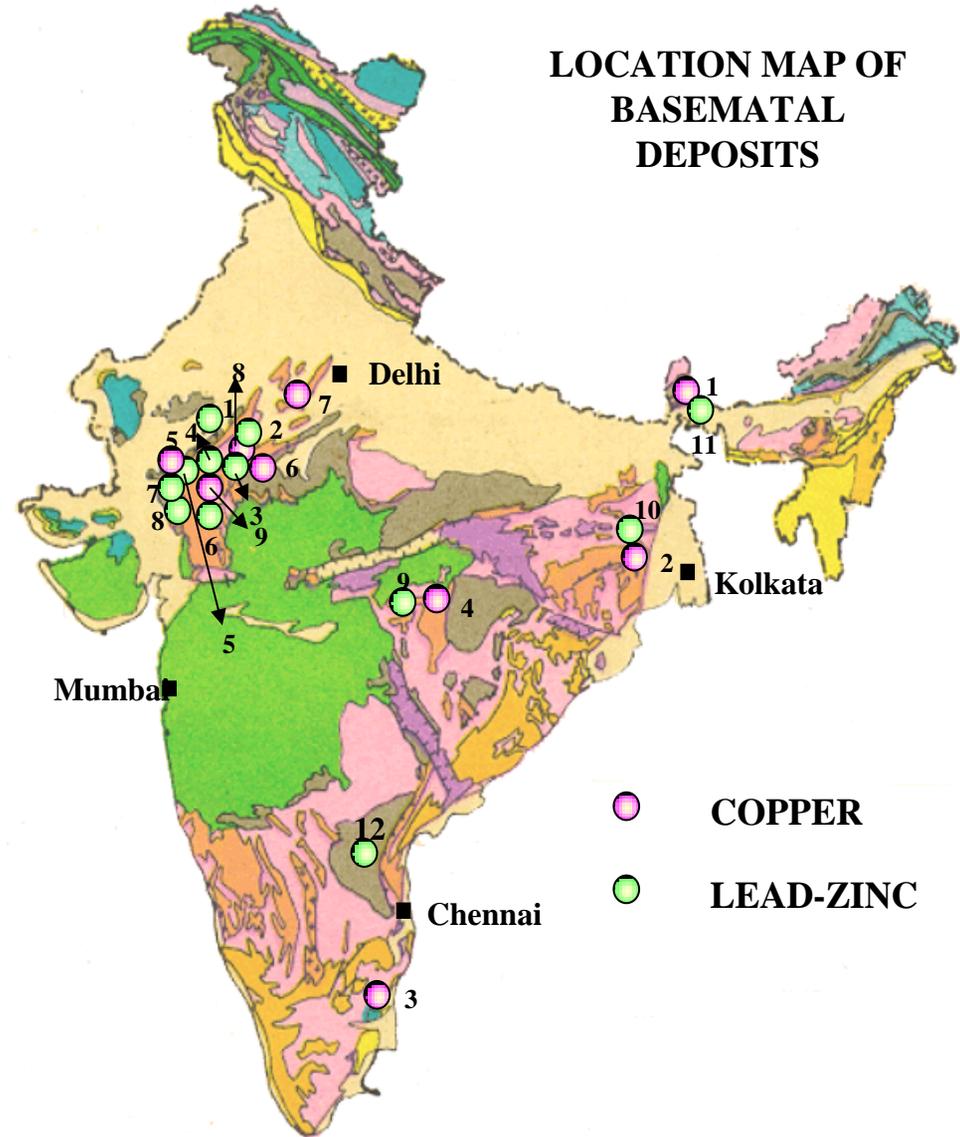
➤ **Total geological Potential area is** ~ 0.18 million sq km. covered ~30% area by Reconnaissance and prospecting (G4 & G3 stage) and 3% of the G3 stages exploration area upgraded to General exploration (G2)

➤ **Major occurrences of base metals are located in**

✓ Late Archaean-early Proterozoic terrains

✓ Proterozoic platform cover province

✓ Granitoid hosted

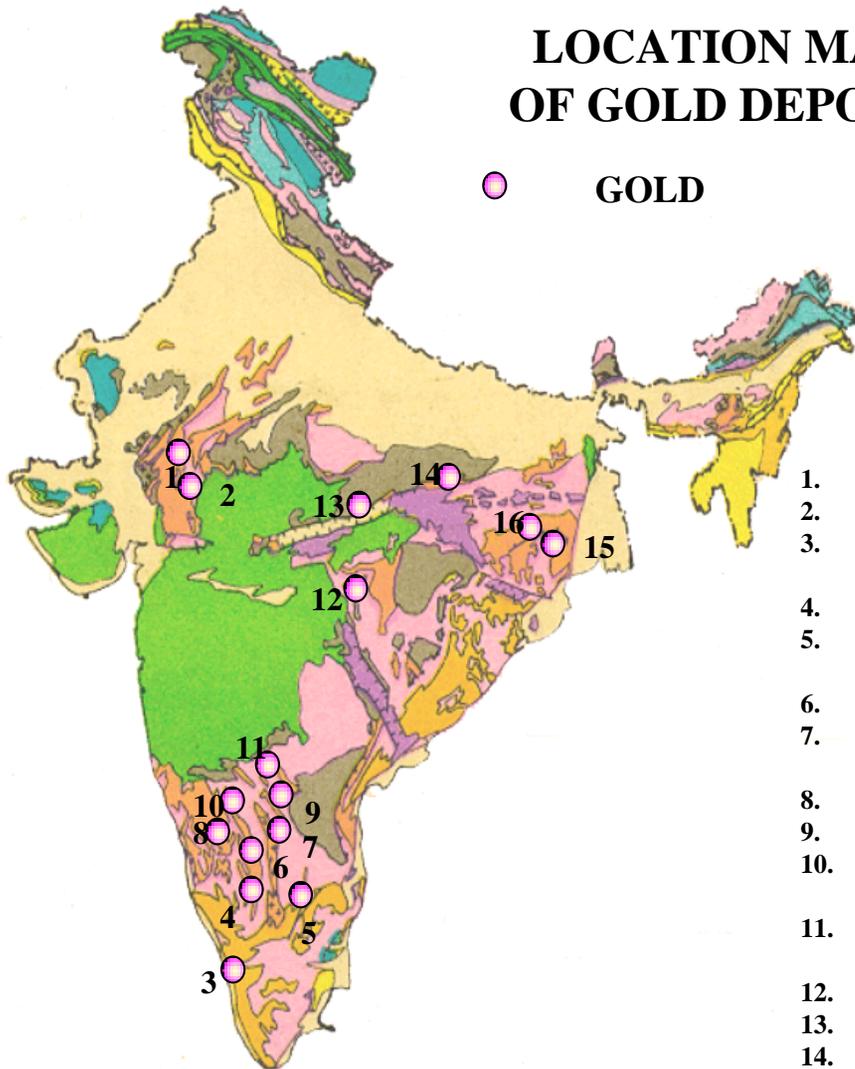




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## LOCATION MAP OF GOLD DEPOSITS

● GOLD



1. Dugocha
2. Bhukia
3. Kottathara,Putt  
umala (E)
4. Kempinkote
5. Chigargunta,  
Mallappakonda
6. Ajjanahalli
7. Bhadrampalle,  
Ramapuram
8. Chinmulgund
9. Dona East
10. Mysore Mine.  
Kabuliyatkutti
11. Hutti Mine,  
Kadoni
12. Parsori,Kitari
13. Imaliya
14. Gurhapahar
15. Kunderkocha
16. Parasi

## GOLD

- ❑ Deficient. Total Resource : 390.29 million tonnes
- ❑ Total Potential Area : ~ 40,000sq.km.
- ❑ Area Covered by Reconnaissance (G4 Stage) 20-25%
- ❑ Area Covered by Prospecting Stage (G3) is ~ 4% of G4 Stage

- **GEOLOGICAL DOMAIN**  
 Archaean granite-greenstone  
 Early Proterozoic Fold Belts  
 Southern granulite terrain,  
 Laterite and Placer



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## PLATINUM GROUP OF ELEMENTS (PGE)

- Deficient, Total resource in metal content (Pt+Pd) is 15 tonnes
- Total geological potential area is about 8000 sq km
- 2% Of total potential area covered by G4 and G3 stage investigation

### PGE environment

#### Peninsular India

- Archaean and early Proterozoic -Plutonic to hypabyssal magmatic intrusions
- Layered differentiated mafic ultramafic complex

#### Extrapeninsular India

- Synorogenic intrusion (ophiolite type, alaskan type) in collisional himalayan fold belts

# INDIA – EXPLORATION & MINING MISSION

## Platinum Group of Elements

- 8000 sq km of total geological potential area
- Only 2% of total potential area covered by G4 and G3 stage investigation

### PGE environment

#### Peninsular India

- Archaean and early Proterozoic -Plutonic to hypabyssal magmatic intrusions
- Layered differentiated mafic ultramafic complex

#### Extrapeninsular India

- Synorogenic intrusion (ophiolite type, alaskan type) in collisional himalayan fold belts

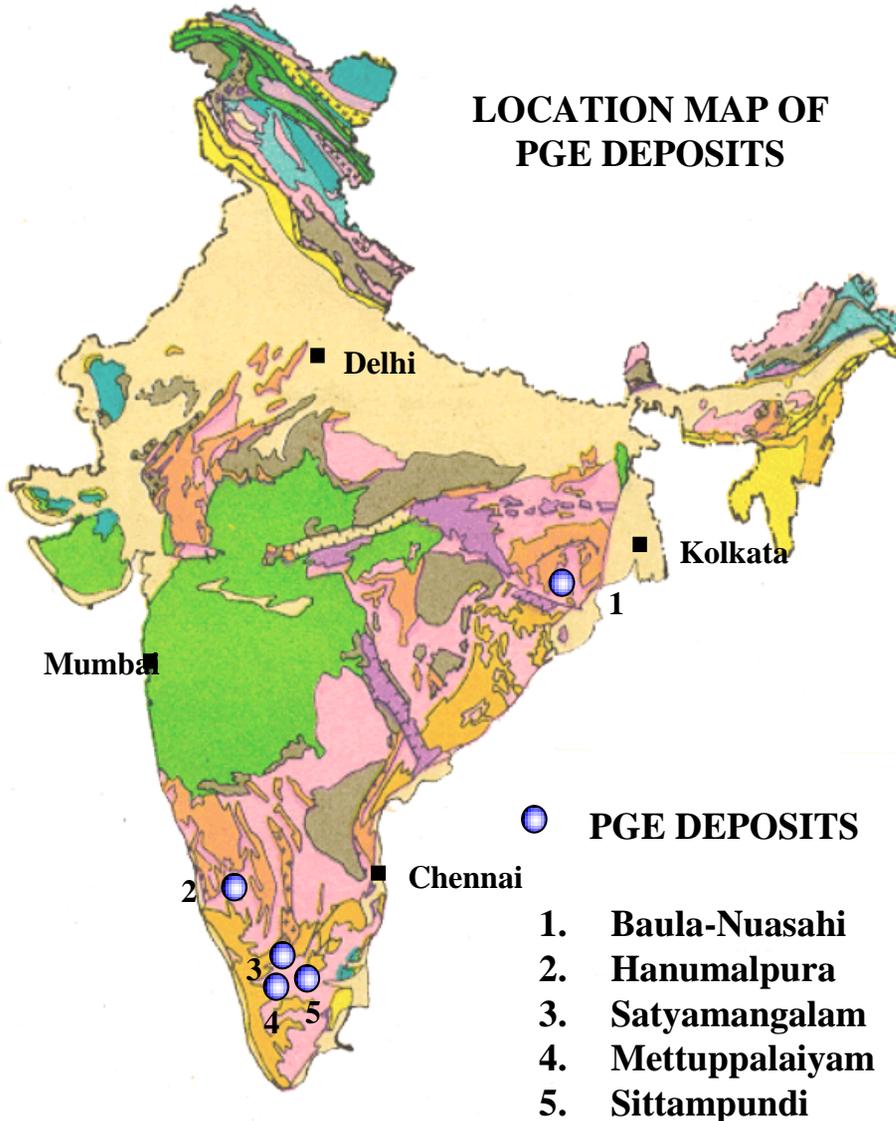
### PGE Exploration and Challenges :

- Technology upgradation and Capacity Building
- Laboratories with modern State-of-art equipments / techniques are to be created
- Case-specific flow sheets are to be designed based on bench scale beneficiation studies of bulk ores on R&D basis
- Collaborative endeavours is open in PGE investigation and for carrying out the beneficiation studies of the PGE prospects already identified



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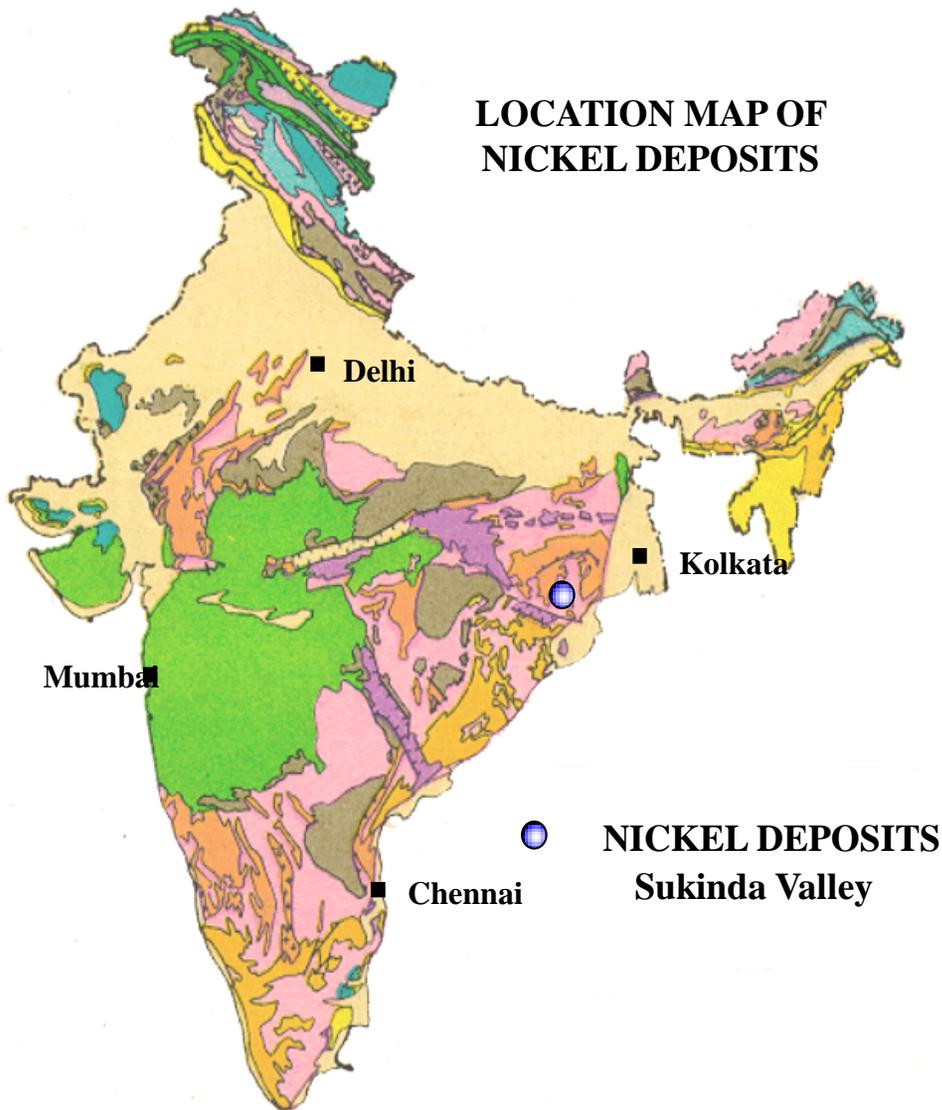
LOCATION MAP OF  
PGE DEPOSITS





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### LOCATION MAP OF NICKEL DEPOSITS



### Ni Exploration and Challenges :

- Major occurrence as nickeliferous Laterite in the overburden of chromite in Sukinda Valley, Odisha
- Other reported occurrences of nickel are as polymetallic sea nodules for which R&D efforts are needed for optimising the metal recovery/processing steps



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## DIAMOND

- **Deficient. Total Resource 3.31 million carat.**
- **Total Reserve 1.20 million carat**
- **Known for world famous diamonds like great Moghul (787 ct), the Koh-i-noor, Pitt/ Regent (41 ct), Nizam (440 ct) and Hope (67 ct), Orloff, Daryia-i- noor etc.**
- **4 Archean cratonic nuclei, which follow Clifford’s rule**
- **Over 200 kimberlites, lamproites, ultramafic lamprophyres, and other alkaline bodies known**
- **Significant part of diamond pipeline – 90% of world diamonds cut and polished in India; 1.2 million people engaged in diamond cutting and polishing, and a million more in diamond jewellery (in effect upto 5-8 million people affected by diamond industry**



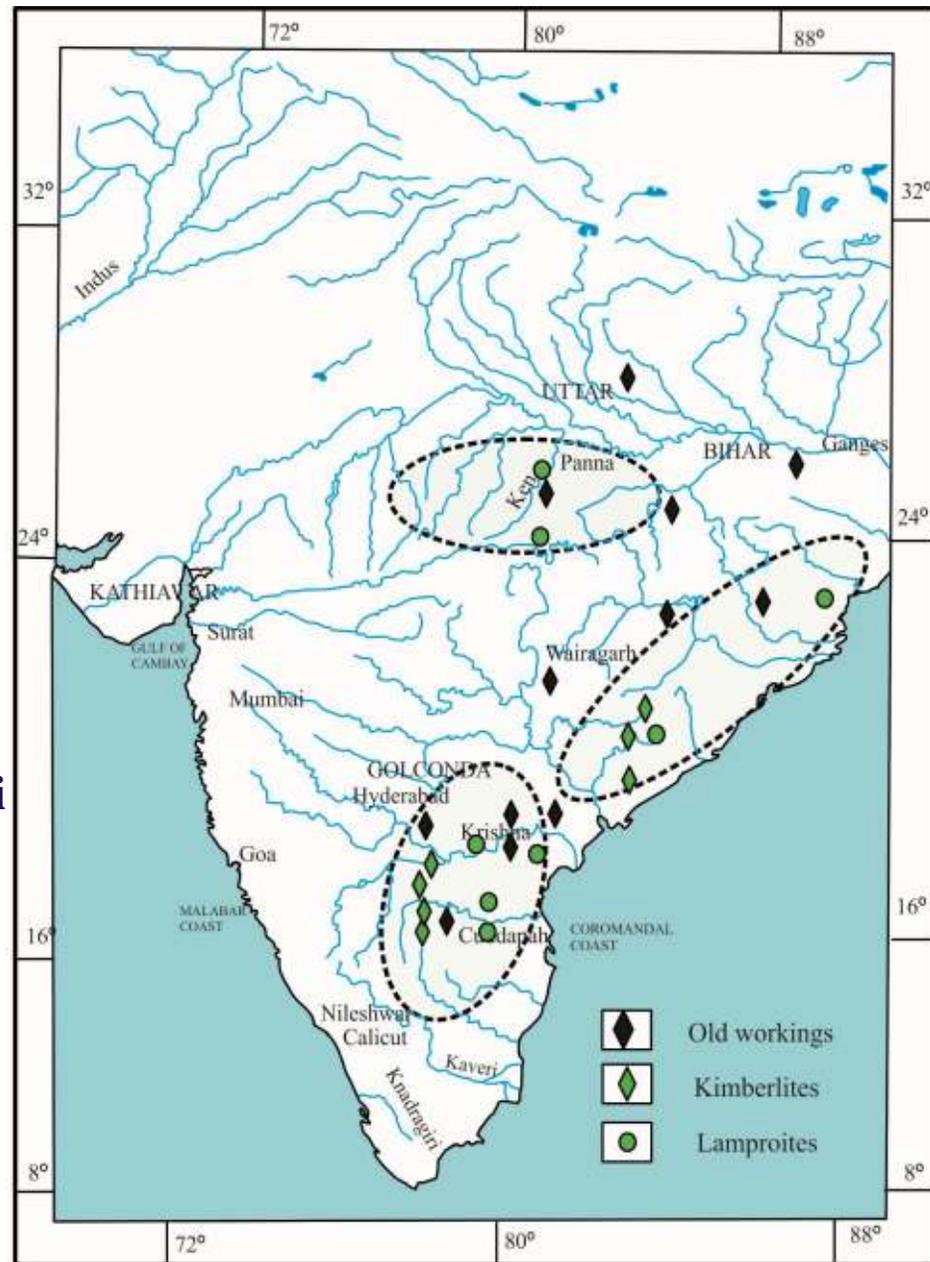
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## Diamond Exploration and Challenges:

- Enhance exploration efforts
  - Technology up-gradation/ New R&D initiative
1. Magneto-telluric (MT) Survey
  2. Low flying high resolution 'Airborne Geophysical Surveys'
  3. Mapping of Sub Continental Lithospheric (SCLM) mantle and cratonic roots for elucidating diamond friendly and diamond destructive events
  4. Technologies for Kimberlite Indicator Mineral analysis (KIM) and diamond processing/recovery

### •TOTAL POTENTIAL AREA:

~3,00,000 Sq Km



Ancient diamond workings and primary sources of India

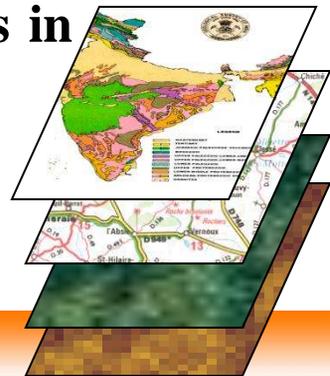


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## INDIA – EXPLORATION & MINING MISSION

### TARGETING CONCEALED AND DEEP SEATED DEPOSITS

- With the near exhaustion of surface proximal resources it has become necessary to apply multi-disciplinary approach for locating concealed mineral deposits.
- Mineral specific concept oriented methodology is required since different minerals are formed in different geological environments.
- Generally, detailed geophysical investigations are done to identify anomalous zones of gravity, magnetic, EM, seismic and deep resistivity.
- Integration of geophysical, geological and geochemical data using advanced software is crucial for success of the investigation.
- Close-spaced deep drilling (>300 m vertical depth) in the identified anomalous zones is done to intersect the mineralized body which enables in delineation of the ore body using sophisticated 3D modeling software.
- **GSI will welcome collaborative venture with Other entrepreneurs**





# Thank You

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