CHAPTER – VIII

SUMMARY & CONCLUSION
It is universal truth that 90% of the intrusive rocks are granitoid, were as 90% of the extrusive rocks are basaltic in nature. For the present study two areas – Dongargarh and Malanjkhand have been taken into consideration. The Dongargarh (District Rajnandgaon, Chhattisgarh) is well known for Barnleshwari Mata Temple and the Malanjkhand (District Balaghat, Madhya Pradesh) is known for the copper deposit. Although in both of these areas have been number of lithological units but for the present study only granitoids have been taken into consideration. Distance between these two granite plutons is 150 km.

As usual the geology of both the areas have been revised time to time and the Dongargarh area has suffered more revision of stratigraphy than the Malanjkhand. Dongargarh Granite (DG) landscape is characterized by scattered, dome shaped, nearly rounded top hills, linear ridge, whose lower part is mostly covered with spheroidal/ blocks (separated due to joints). The geological set-up of Malanjkhand (MG) exhibits an elusive simplicity picture with two divisions of the Archaean; both of these having a typical characters and are separated by a hiatus.

MG is situated on the south of the Central Indian Suture Zone and it hosts a major Cu-Mo deposit in the Indian Peninsula. The area is stratigraphically constrained but geochemically well characterized. MG varies in composition from granodiorite to tonalite andalkaline in nature.

The deposit is hosted by a thick, highly sheared quartz vein (quartz reef) emplace within the K-rich pink granodiorite. Quartz reef has copper
mineralization and granitoid contents Mo mineralization. This deposit is a 'porphyry type copper deposit' or not is still a debatable matter. The porphyry type copper deposits tend to occur in clusters and normally a number of such deposits are found in a given geological district and therefore, these may occur several ore bodies within the Malanjkhand granitoid.

Enclaves are common in DG and Mg. In DG the enclaves represent the invaded underlying rock e.g. Bijli Rhyolite and Pitepani Volcanics belongs to Nandgaon Group. MG have metabasic enclaves.

Dongargarh granite (DG) complex is represented by porphyritic to fine grained granite, granophyre, coarse equigranular granite and rapakivi granite. The granitoids of Malanjkhand area (MG) include tonalite, trondjhemite, granodiorite to quartz-diorite. Variation of colour of the rock with the colour variation of feldspar. Discordant intrusive bodies of aplites and dolerites are common in both the areas. Fluid inclusions present in DG are relatively less in number and smaller in size than the MG. Tm of DG varies from -15 °C to -16 °C and Th varies from 100 ° to 280 °C. Th of MG varies from 140 °C to 350 °C with Tm about -61.4 °C.

Tripartite classification of granitic rocks are peraluminous, metaluminous and eralkaline. DG and MG both are metasluminous in nature. Metaluminous character as defined by number of workers (Clarke, 1992) is as follows and these characters well matches with these (DG & MG) granitoids.

1  Quartz  60% > Quartz > 20%
2  Alk - felds / (alk - felds + Plag.) = 0 - 1
3 CNK > A > NK
(Shand, 1947)

(A = mol Al₂O₃, C = mol CaO, N = mol Na₂O, K = mol K₂O, CNK = C + N + K, NK = N + K)

4 Characteristic minerals
- orthopyroxene, clinopyroxene,
  cummingtonite, hornblende, epidote.

5 Other common minerals
- biotite, minor muscovite.

6 Oxide minerals
- magnetite

7 Accessory minerals
- apatite, zircon, titanite, allanite.

8 Isotopic composition
- 0.7030 – 0.7080.

87Sr/ 86Sr

9 Typical mineral deposits
- porphyry Cu – Mo.

10 General plate tectonic
- subduction – related continental and island environment
  arc.

Modern magmatic arc plutonism may have tonalite and trondhjemite as major components but these rocks dominate in early Archaean tonalite – trondhjenite – granodiorite (TTG) terrains. Archaean TTG gneisses are relatively homogenous with a modal mineralogy of 25–35% Qz + 40–60% Plag.(An 20-25) + 5-10% Biotite ± 0-5% Hornblende. These rocks, with A/CNK ~ 1, K₂O/Na₂O < 0.5, high Ba and Sr. The DG and MG (Fig.V-12, An-An-Or) plots in the granite and trondhjemite respectively. Plots of these granitoids donot fall in the field (Fig.V-12)indicate that they may not be of pre & syntectonic nature. DG and MG have more albite and plagioclase and less quartz than the granites (Fig. V-11). DG consists more albite and MG has more plagioclase. DG do not show any indication but MG plots in the Island Arc Granitoids in Q-A-P diagram (Fig.V-13). In unstable condition of the mineral Rb was released and added in the magma.
Negative correlation of Ba and Rb in DG & MG, suggests that the melting out of potash feldspar and to a lesser extent some mica from the protolith if it was present. The triangular plots of Rb-Sr-Ba for DG & MG, suggests that both of these may not be the direct product and also may not be the first stage formed and tectic melts. Both these granitoids show a low differentiated attitude. Comparison of salient points of these two granitoids (DG & MG) have been given in table VIII-1.

It is wellknown fact that these are many obstacles in unraveling the petrogenetic history of granitoids. The common obstacles are obscured and unclear field relations, polyphase metamorphism and uncertain (Plate 4) tectonic setting. Despite these huddles, sincere affords have been made to apply reliable petrogenetic tools to search many answers and these were given in the text in a systematic manner to fill up the gap of knowledge of these two granitoids of Proterozoic age.
<table>
<thead>
<tr>
<th>Particulars</th>
<th>DONGARGARH GRANITE</th>
<th>MALANJKHAND GRANITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Location</td>
<td>Topo Sheet No. 64 C/12, C/16 Long. &amp; Latitude – N80°42'30&quot; - N 80° 47' E21° 07' 30&quot; - 21° 12' 30&quot; District – Rajnandgaon, C.G.</td>
<td>Topo Sheet No. 64 C/11, C/15 Long. &amp; Latitude – N80°40' - N 80° 45' E22° 00' - 22° 05' District – Balaghat, M.P Lies about 150 km north of the Dongargarh Granite.</td>
</tr>
<tr>
<td>2 Nature of outcrop</td>
<td>Granitoids are exposed in the form of hills and these are connected by soil.</td>
<td>Poorly exposed, mostly covered by soil. Good and fresh sample are present at the mine area.</td>
</tr>
<tr>
<td>3 Colour variations &amp; grain size</td>
<td>Pale pink to grey with little variation. Medium to coarse. Mineral lineation is not found.</td>
<td>Pale pink to flash colour, grey colour is for another group. Gneissic structure is common.</td>
</tr>
<tr>
<td>4 Mineralogical composition and name of rock</td>
<td>Quartz, K and Na feldspar, biotite, hornblende, alk-granite, granite, granodiorite to quartz monzonite associated with aplite and dolerite.</td>
<td>Quartz, K and Na feldspar, biotite, hornblende, pink granite and grey gneissose granitoid are associated with conglomerate, grit, phyllite, laterite, quartz reef.</td>
</tr>
<tr>
<td>5 Enclaves</td>
<td>Rhyolite (lense shaped) and metabasic rocks (subrounded) xenocrysts are common.</td>
<td>Metabasic enclaves are common.</td>
</tr>
<tr>
<td>6 Fluid Inclusion</td>
<td>Biphase and uniphase both the types of aqueous inclusions are present. Th varies from 120°Cto 280°C. Tm varies from –15°C to –16°C.</td>
<td>Number of inclusions are less and smaller in size than DG. Biphase inclusions are more common. Th varies from 140°C to 350°C.</td>
</tr>
<tr>
<td>7 Major Elements</td>
<td>Much more than average Granite – Ba, Cr, Sr, Zr &amp; Sn, Cu, Ni, Rb &amp; Y conc. Are either equal or less.</td>
<td>Much more concentration than average granite – Cr, Cu, Ni, Sr, Zn and Sn. Lower concentration than average granite Ba, Rb+Y.</td>
</tr>
<tr>
<td>8 Trace Elements</td>
<td>DG – 2270 ± 90 to 2465 ± 22 Ma</td>
<td>K-Ar dates - 1684 ± 67 Ma to 1818 ± 73 Ma (age of migmatization). Age varies from 2106 ± 102 to 2467 ± 38 Ma</td>
</tr>
<tr>
<td>10 Petrogenesis</td>
<td>Follows the skirgaud intrusive trend crustal contamination – Crustal source Depth of formation – 25 to 30 km P &amp; T condition – Or-Ab-An relation shows the temp. range 650°C to 685°C, calculated temp. is 830°C to 999°C &amp; 625°C to 750°C</td>
<td>Follows the normal igneous trend. Partial melting of crustal source 30 to 35 km. Or-Ab-An relation shows the temp. range 650°C to 685°C, calculated temp. is 999°C to 1165°C &amp; 750°C to 875°C</td>
</tr>
<tr>
<td>11 Type of granitoids &amp; relation with orogeny</td>
<td>I-Type, Late-orogenic</td>
<td>1 - Type, Late-orogenic to syn-collision.</td>
</tr>
<tr>
<td>12 Special features</td>
<td>Non-mineralized granite. Used as building materials – polished slab &amp; gitti. Hills (mostly) are crowned with Temple, Church, Statue, etc.</td>
<td>Cu-Mo mineralization occurs. Outcrops are poor and lacks fresh rock. One temple of lord Shiva present on the hill top (near to the town).</td>
</tr>
<tr>
<td>13 Tectonic settings</td>
<td>Volcanic Arc Granite (V&amp;G)</td>
<td>Volcanic Arc Granite (V&amp;G)</td>
</tr>
</tbody>
</table>
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