Present Research Activities:

I. In the last several years, Professor Gupta has been active with his research associates to study the complex system, nepheline-kalsilite-silica, termed Pertrogeny's Residua System by Norman Bowen. Professor Gupta studied the silica-undersaturated part of this system at 2 GPa and variable temperatures in presence of excess water. In their investigation, they not only made elaborate studies on the bounding complex joins: 1.) nepheline-kalsilite, 2) kalsilite-K-feldspar, 3) albite-K-feldspar, 4) albite-nepheline, but also established that nepheline (Ne)-kalsilite (Kls)-K-feldspar-albite quartnary join has two eutectics, 1) one at $Kls_{18}Ne_{32}(SiO_2)_{50}$ and 620±10°c, where $jadeite_{ss}$, $sanidine_{ss}$, $nepheline_{ss,}$ liquid and vapour are in equilibrium, and the other 2) at $Kls_{35}Ne_{32}(SiO_2)_{27}$ and 625±10°C, where Ne_{ss}, San_{ss}, Kls_{ss}, liquid and vapour coexist in equilibrium. Gupta and his group have established that under 2 GPa Ab-Kf joint no longer exist**s** a**s** a thermal barrier but jadeite- K- feldspar become the new thermal devide. Hence, all the starting compositions within the join, albite-K-feldspar-jadeite may produce feldspathoid-bearing volcanic rocks at lower pressures but melts of same compositions should move towards the albite-K-feldspar-quartz eutectic at high pressure yielding silica rich feldspar bearing rocks, as observed in number of petrographic provinces (e.g. Somma-vesuvius region Coli Alabani and Vico, Italy; Bufumbira region of East Africa, Highwood Mountains, Montana, U.S.A, etc.).

II. The system Forserite-Diapside-Enstetite at 7 GPa and variable temperatures:

A.K. Gupta along with his student S. Dasgupta recently studied the model mantle system forsterite-diopside-enstatite at 7 GPa and variable temperatures. Dasgupta and Gupta (2012) observed that in the diopside-enstatite join at 7 GPa, diopside incorporates 72 wt% $MgSiO_3$ in solid solution, corroborating the observation that orthopyroxene does not appear in the subsolidus experiments related to peridotites under higher pressures. They further observed that the minimum point in the enstatite-diopside join occurs at $En_{65}Di_{35}$, and enstetite on the other hand can incorporate close to 10 wt% diopside at 7 GPa at 2000°C. They established that the cotectic line between enstatite-forsterite and forsterite-diopside eutectics contains a reaction point R at $Fo_{54}Di_{35}Q_{11}$, where $forsterite_{ss}$, $diopside_{ss}$, $enstatite_{ss}$ and liquid coexist in equilibrium at 2010±10°C.

They demonstrated that if the bulk composition of a peridotite contains at least 22 wt% clinopyroxene, then the evolutionary trend of a komatiitic melt should resemble that of the Gorgona komatiite from Columbia. In case of Gorgona komatiite, crystallization of olivine is followed by the appearance of clinopyroxene in the groundmass. If the bulk compositon is similar to a harzburgite, following trend should be observed, as demonstrated by phase equilibria study of Dasgupta and Gupta (2012): olivine+l→ olivine + orthopyroxene+1→olivine+orthopyroxene + pigionite + 1→olivine + ortpyroxene + pigeonite+ clinopyroxene + l. This trend is similar to the trend observed in case of Alexo komatiite (S. Africa) and Karasjok Komatite (Norway).

III. **Rate of Ascent of a Kimberlite Magma:** Gupta and his associates have been pursuing research in connection with rate of ascent of a kimberlite magma. They synthesized a rock, mineralogically, representing a kimberlite containing 60 wt% forsterite, 20 wt% enstatite, 10 wt% dolomite and 10 wt% pyrope. The rock was synthesized at 20 kb and 1000°C. They then designed several sets of experiments, each set of run containing a mm long diamond. The kimberlite with a piece of diamond was then placed at 1250°C and 7GPa. The temperature was then lowered at 3, 5, 8 and 10 m/sec. Resitivity measurement of the diamond crystal was also made simultaneously. It should be mentioned that diamond is not conductive at all. It was established by Gupta and his associates that if the cooling is faster than 10 m/sec., diamond remains intact, but if the rate of cooling is slower than 5-8 m/sec., most of the diamond is converted to graphite.

The above description summarizes the current research activity of Professor A.K. Gupta and his associates.