Action taken Report on Peer review comments on the GR of "Reconnaissance survey (G4 stage) for Rare Earth Elements (REE) and Rare Metals (RM) in Samalpatti block, Krishnagiri district, Tamil nadu. (Block id: KIOCL_57_TN_SREE)

1. The NGCM and NGPM surveys carried out by GSI provide an important geochemical and geophysical framework for the Samalpatti block. The integrated analysis of TREE and LREE data (NGCM) with Bouguer gravity data (NGPM) indicates a well-defined REE anomaly associated with a distinct gravity feature, suggesting a structurally controlled alkaline–carbonatite system. These datasets form a sound basis for identifying prospective zones and justifying the present investigation, and may be appropriately mentioned in Chapter 9.

   Reply : NGCM and NGPM data interpretation maps along with sub blocks demarcated are appended in Chapter no 9.

2. The lithological description of carbonatite (Chapter 10) should be complemented by a separate and detailed description of fenite, including both megascopic and microscopic characteristics, as these represent fundamentally different geological products—carbonatite being an igneous intrusive phase and fenite a metasomatic alteration product developed due to carbonatitic fluid interaction. Clear distinction between these units is essential for proper interpretation of mineralisation androck genesis. Wherever adequate geochemical data are available, appropriate rock classification and discrimination diagrams (e.g., TAS classification for syenites and relevant plots for carbonatites) may also be included to support the lithological interpretations.

   Reply : Attended by adding detailed description ,TAS (Fig 21) and Carbonatite Mgo-Cao-Feo Plots (Fig 22,23 &24)**.**

3. It is suggested that rock-type-wise REE values from the Samalpatti block be compiled and compared with corresponding data from well-studied Indian carbonatite complexes such as Ambadongar Carbonatite Complex and relevant global carbonatite occurrences. This will enable evaluation of the relative enrichment levels, highlight similarities or differences in REE distribution patterns, and strengthen the interpretation of the mineralisation potential.

   Reply : Attended (ref chapter no 21(b))

4. Additional geochemical discrimination plots may be attempted to better characterise the nature of the carbonatite–fenite system and associated REE mineralisation. These may include:
   (i) CaO–MgO–FeO plots to distinguish different types of carbonatites (calcic vs magnesian),
   (ii) CaO *vs* SiO_2 plots to differentiate carbonatite from silicate-rich fenite/hybrid rocks.
   (iii) La/Yb *vs* TREE to assess fractionation patterns and distinguish primary carbonatitic

signatures from metasomatically modified or hybridised zones,

(iv) TREE vs Nb (or Nb/Ta) to evaluate magmatic affinity versus possible remobilisation effects, and

(v) TREE vs CaO to examine the relationship between REE enrichment and carbonate content. Such plots would help constrain the petrogenetic evolution, degree of metasomatism, and controls on REE distribution in the study area.

Reply : Attended

- CaO–MgO–FeO plots is attended (Fig 22,23 &24).
- CaO *vs* SiO_2 plots is attended (Fig 59)
- La/Yb *vs* TREE plots is attended (Fig 54 & 55)
- TREE vs Nb (or Nb/Ta) attended (Fig 56)
- TREE vs CaO plot is attended (Fig 60)

5. The comparative table (Annexure 11) of REE assays between the primary laboratory (KIOCL) and the check laboratory (Shiva Analytical) shows large differences, commonly in the range of 20–70%, with the check laboratory generally yielding higher values. This indicates the presence of a systematic bias between the two datasets. The magnitude of discrepancy exceeds normally acceptable limits and represents a significant QA/QC concern. The variation may be attributed to factors such as the complex nature of the mineralisation, including the presence of refractory REE-bearing minerals (e.g., monazite, bastnäsite, and REE-carbonates), possible differences in digestion protocols, and sample heterogeneity. A variation of about 10–15% is generally considered acceptable in check assay analysis. The higher discrepancies observed in the present dataset indicate the need for further validation of the analytical data and QA/QC protocols. This is further reflected in the scatter diagram (Fig. 49), which shows widely scattered data points and a low correlation coefficient ($R \approx 0.6$), indicating poor agreement between the two datasets.

   Reply : Attended.

   - Initially samples were analyzed with acid mixture of HNO3 and HCL with 1 to 2 hrs of digestion.
   - As per the observations above, all the samples were re- analyzed with digestion system of acid mixture of nitric acid (HNO3) and hydrofluoric acid (HF) with 4 to 5 hrs of digestion.
   - Primary samples shows a positive correlation with external check samples, with a correlation coefficient of 0.99.(Ref Chapter No 15.4) and TREE (ppm) of all samples are falling within the best fit curve, which are having a slope of 1.1118 (Ref fig 65).

6. The borehole log data and cross-sections indicate that anomalous REE values in the range of 0.1– 0.3% continue up to the end of the drilled depth, suggesting that the mineralised zone remains open at depth. Further, comparison with trench data indicates that the full width of the carbonatite–fenite zone has not been adequately exposed at surface by "master trenches". Accordingly, the true width and lateral extent of the mineralised zone are not yet fully established and require further investigation.

Reply : Attended (Ref Point 4 of Recommendations.)

7. The available trench & borehole data indicate that REE mineralisation within the carbonatite–fenite zone is fairly uniformly distributed. REE values are generally highest in carbonatite-rich zones and show gradual reduction toward the adjacent wall rocks, such as syenite and pyroxenite, suggesting a zoned mineralised corridor rather than isolated patchy enrichment. The preliminary frequency distribution (Figure 37) also appears broadly 'bell-shaped', indicating a near-symmetric to only slightly skewed grade population, although this requires further statistical validation. These points may be highlighted in the text.
   Reply : Attended (Ref Para below Fig 43)

8. The threshold limits prescribed by IBM, if available for REE mineralisation, should be adopted. In the absence of notified threshold values, the grade cut-off may be determined based on practices followed by recognized exploration agencies and relevant literature, so as to ensure a realistic basis for grade and resource estimation.
   Reply : Necessary data is incorporated in Chapter No 19.5 (Cut off grade).

9. In addition to REE, rare metals such as Sc and Nb have also been targeted in the Samalpatti block. Their distribution pattern should be discussed at appropriate places in the report, particularly in relation to lithological control, carbonatite–fenite association, and their correlation with REE mineralisation and associated mineral phases.
   Reply : Discussed in chapter 13.12 (Additional Geochemical Diagrams)

10. Chapter 19.7 on ore zones requires further elaboration. It should include a brief description of the carbonatite and fenite zones, incorporating key petrological observations and their relationship to REE mineralisation. The description should clearly identify the REE-bearing minerals observed, preferably in order of relative abundance, along with associated ore minerals such as apatite, barite, magnetite, etc. The chapter should also present grade characteristics of the mineralised zones based on the adopted cut-off grade, including variation of grades along boreholes and within different lithological units (in Table form). In addition, the association of REE mineralisation with other geochemical parameters (e.g., Ba, Sr, Nb, Ta, and LREE–HREE distribution) should be discussed to better define the mineralised zones and their controls.
    Reply : Chapter No 19.7 on ore zones elaborated with brief description of the carbonatite and fenite zones and zones along with TREE value established through trenches and boreholes is enclosed in Table 30.

11. The resource estimation for the block is based on limited trench data, scout boreholes, and supporting geological mapping. Given that the mineralisation appears to be structurally controlled and exhibits broad homogenous distribution, the lateral continuity assumed in the present estimation is subject to significant geological uncertainty. Accordingly, the resources computed at this stage should be regarded as highly conceptual in nature. The cross-sections used for resource estimation are therefore

interpretative and schematic, as the controls on grade distribution are not yet fully understood. While structural features such as fractures and their intersections are likely to play an important role in the localisation of carbonatite emplacement and REE mineralisation, their geometry and continuity have not been adequately constrained at the present stage. This aspect needs to be explicitly highlighted in the report to avoid any potential misunderstanding regarding the nature of the resource estimation.
Reply : Attended (Ref Para 2 of Chapter No. 20.1 Resource estimation by Cross section method)

12. A considerable thickness of soil (approximately 1–3 m) is developed over the alkaline terrain, and limited analytical data indicate anomalous REE concentrations in the soil horizon. Although extraction of REE from such material may be challenging, it would be useful to make a preliminary estimate of the soil resource within the block. This would help assess its potential as a secondary or supplementary source of REE, subject to further evaluation of its economic and metallurgical viability.
Reply: Attended (Ref Point 5 of Recommendations.)

13. The summary presented in Chapter 21 requires revision to clearly highlight the major findings of the G4 stage investigation (and not any quantum of work done). It should briefly bring out the key outcomes of geological mapping, petrological studies, trenching, and drilling, along with the salient features of the analytical data. The summary should also include a clear statement on grade characteristics and the conceptual nature of the resource estimation.
Reply : Summary is revised accordingly. (Ref Chapter 21).

14. The recommendations section of Chapter 21 may be strengthened considering the strategic importance of rare earth elements and the need to enhance domestic resource security, further detailed evaluation of the prospect is warranted to clearly reflect the need for a systematic and staged exploration programme to establish the continuity, geometry, and grade distribution of the carbonatite–fenite mineralised system with a higher level of confidence.
Reply : Summary is revised accordingly. (Ref Chapter 21).

15. You are in receipt of an excellent petrological and microprobe inputs which need to be properly incorporated in the main text at relevant places other than in annexure.
Reply : Attended at relevant places.

16. All corrections and modifications suggested in the text, annexures and plates may be fully attended.
Reply : Attended at relevant places.

.

****