

***Interactive comment on “Application of unsupervised pattern recognition approaches for exploration of rare earth elements in Se-Chahun iron ore, central Iran” by Mohammadali Sarparandeh and Ardeshir Hezarkhani***

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Dear Anonymous Referee #1

We really appreciate you for very useful scientific comments. They helped us to promote the quality of the paper. We carefully considered all comments and made the relevant changes. Some additional explanations and Figure 7 had been added to initial version of the manuscript (after quick review). They are highlighted by yellow. In

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addition, new changes were applied in the marked-up manuscript version (using track changes in Word). The comments and author's responses and changes were classified as following: ĩĈij

comments from Reviewers

1 The manuscript does not provide substantial new information of interest. The paper does not provide sufficient theoretical motivation and does not provide enough information about state of art about the four methods (modified basic sequential algorithmic scheme (MBSAS), hierarchical (agglomerative), k-means and SOM) applied in this field of study.

2 The manuscript needs additional theoretical development and explication of the data and analyses. The data and analyses are not sufficiently justified. ĩĈij

author's response

1- Potential of Central Iran for REEs needs more attention. Exploration aspects of REEs was studied by authors in Se-Chahun deposit using bulk lithology samples for first time. Moreover, the application of unsupervised pattern recognition in exploration of REEs has not been considered before. We have used new original dataset which has been produced by ourselves. We mentioned in the text: “In this study, pattern recognition helped to divide the samples in appropriate groups, according to the contents of REEs and results are consistent with the concentration of P and also lithology of the samples. Variety of parameters, especially in case of REEs explorations makes some complication for interpretation of data and exploration area. Since, single-variable methods don't provide useful information, the authors proposed four common clustering algorithms”. We think that this paper suggests a new approach for exploration of REEs which is more applicable and compatible with multi-variate nature of them. As it was mentioned in line 15 of the first page, the proposed method helps to find some hidden information from dataset which are not easily achievable in usual. For example, in this study we found a cluster that had not been considered before. It

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was previously believed that the concentration of rare elements is directly related to apatite and consequently phosphorus. This hypothesis is generally correct. However, in cases with medium amounts of REEs, we found that there is a different condition. In fact, we have another group of samples in which there are lesser amounts of P with considerable concentrations of REEs. This group of data was separated easily by clustering methods. It confirmed by evaluation of samples under SEM. After a complete survey of samples under SEM, we found that the samples of this cluster (figure 7, b) contain monazite but no apatite. Since only the rare earth elements were used in this division, a good agreement of the results with lithology is considerable (line 21).

2- Some explanations were added to complete and explication of the data and analyses (lines 25-28 of page 3, lines 11-20 of page 8 and Table 3). Representative samples of Figure 7 and Table 3 and mentioned explanations explicate the data and analyses and show the performances of clustering methods.

author's changes in manuscript

All the changes are marked in "marked-up manuscript version". The changes after quick review were highlighted by yellow color. The changes which are related to Referee #2 were highlighted by green. Recently changes were marked using track changes in Word.

Best regards,

Authors.

Please also note the supplement to this comment:

<https://www.geosci-instrum-method-data-syst-discuss.net/gi-2017-38/gi-2017-38-AC3-supplement.zip>

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Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss.,  
<https://doi.org/10.5194/gi-2017-38>, 2017.