Instrumental photon and proton activation analysis of some elements in stony meteorites

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Summary

This thesis deals with the application of two instrumental activation analysis techniques to stony meteorites.

In chapter I a survey is given of the principles of activation analysis, of the different types of activations and of procedures for the determination of the induced activities. This chapter also contains a brief introduction into "meteoritics".

In chapter II the determination by photon activation of Fe, Ni, Mg, Ca and Cr in stony meteorites is dealt with. After a treatment of the general properties of bremsstrahlen and their consequences with respect to photon activation analysis, the techniques applied in this work are discussed. Finally results on a large number of meteorite samples are reported.

Chapter III starts with a treatment of charged particle activation analysis. After a discussion of the specific problems which arise in the application of this technique on meteorite samples, the activation procedures used to determine Fe, Ni, Ca, Ti and Cr by proton irradiation are described, and some results are reported.

The first part of chapter IV is devoted to the discussion of the analytical techniques. Error sources not yet discussed in the two previous chapters, error limits and limits of detection are dealt with and the advantages and disadvantages of both techniques are discussed. Moreover a comparison is given with other possible kinds of activation.

In the second part cosmochemical conclusions from the results obtained in this work are discussed. A correlation is established between the Ni content and the amount of Fe exceeding 7%. Some theories on the origin and evolution of meteorites are summarized and it is tried to fit our results into these theories.
A correlation is established between the Ca and Ti contents. A nearly constant ratio of these contents is found for all classes of stony meteorite material. This ratio is compared with those found on earth and in the stones collected from the lunar surface.