METAL ENRICHMENT IN THE FIRST AGES OF THE GALAXY

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It is obviously interesting to study in detail the chemical composition of extreme Population II stars since they may give indications about the processes which took place in the very first ages of the Galaxy.
It is well known that de abundance of metals in the stars of extreme Population II are smaller than in Population I stars, but it is not yet clear from the literature if all the metals, in all the metal deficient stars, are deficient by the same factor or not. However some anomalies were shown in some halo stars : over-deficiency of barium, "s process" element (Pagel 1965), over-deficiency of odd elements (Arnett 1971, Peterson 1976). These differences are however difficult to measure and are not very much larger than the possible errors of the analysis, so that according to Trimble 1975 they are "not proven".

It was then decided to build a sample as homogeneous as possible, of stars with very large metal deficiency in order to bring out trends observable by averaging effects. For this, three new extreme halo stars HD 84903, HD 128279, HD 184711 were observed and analysed. (Let us stress that up to now only 2 stars with such a high deficiency were known: HD 122563 and HD 140283). The equivalent widths of other stars have been gathered in the literature, and were processed in the same manner. We present here the main results of this study ; their derivation and the details are described in a paper submitted to "Astronomy and Astrophysics" (Spite and Spite 1977).
These stars have about one hundreth of the solar metal content.
If existing at all, the over-deficiency of odd elements is smaller than the errors of the analysis. (The lines of all these elements are generally widened by hyperfine structure and therefore the determination of the abundance of the element, in this case, is not very good).
This agrees with the predictions of a new theory of Arnett (private communication, 1977).
The r process element Europium has the same behaviour as iron : no over-deficiency, no enhancement. Barium is over-deficient. This over-deficien-

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cy is large: Ba/Fe $<(Ba/Fe)_\odot/3$, for very iron poor stars (Fe/H $<(Fe/H_\odot/150)$ and becomes small (of the order of the errors) when the iron deficiency becomes moderate (1/30 of solar iron content).
This means that barium enrichment in the first ages of the Galaxy was quicker than the iron enrichment. The barium enrichment rate is quite the square of the iron enrichment rate. This implies consequences about the site where barium is built and the stars formation. If, as it is generally assumed, the iron abundance increases rapidly from 1/500 to 1/30 of the solar abundance, the increase of barium abundance in the same time interval can be achieved only if barium is built at least partly in massive short lived stars (cf Rocca 1977).
In view of the consequences which can be derived from this behaviour of barium, let us point out that the slope of barium abundance versus iron abundance is fairly independant of a possible change of the temperature scale (we adopt the Johnson's temperature scale).
An indirect confirmation of barium behaviour is found in the behaviour of another s process element the yttrium. This element is over-deficient as well but in a lesser degree than barium. The ratios Fe/Y and Y/Ba may be accounted by the theory of Seeger et al. (1965). We tried to go further and check the ratios Ba/Ce and Ba/Nd. This check is not conclusive but due to the fact that Ce and Nd lines are very faint, this failure should not be taken too seriously.

As a conclusion it could be said that the metals of extreme population II stars are all deficient by approximately the same factor except for s process elements. This fact is somewhat surprising but it possibly may throw some light on the fact that the relative abundances in external galaxies are rather similar to solar relative abundances.

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