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Lithium as Probe of the Scenarios of the chemical enrichment of the Galaxy

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Abstract. Jehin et al. (1999) find that, in a sample of moderately metal-poor stars, a group is rich in s elements, and they propose an enrichment by accretion of matter by the winds of AGB stars. We tried to check the implications for the lithium abundances.

1. Introduction

Recently Jehin et al. (1999) presented very careful determinations of abundances in a sample of 21 mildly metal-poor stars, ($-1.3 <$ [Fe/H]< -0.8), in particular, the abundances of the heavy elements. They show that the abundance of Europium, an element formed by the r process (rapid addition of neutrons) is uniformly correlated with the abundance of the α elements (like magnesium and titanium). This is expected, since both α elements and r elements are supposed to be produced and ejected by the same kind of massive supernovae (SN II).

On the contrary, the behaviour of the s elements (produced by slow addition of neutrons), relative to the α elements is not linear (cf. the behaviour of Yttrium in Fig. 1). In a first group of stars (0.0< [Ti/Fe] < 0.23) there is a good correlation between [Y/Fe] and [Ti/Fe], but in the second group [Ti/Fe] is gathered in the narrow range 0.23 – 0.25, whereas the spread in [Y/Fe] is large. This second group is (in average) Y-rich.

2. A scenario

Jehin et al. suggest a scenario based on two distinct phases of chemical enrichment: a first phase by the products of supernovae explosions of massive stars (SN II) a second phase by the stellar winds from intermediate mass AGB stars. Generally, the AGB produce both lithium and s process elements. In this case it can be expected that the second group (Y-rich) is also Li-rich. In some cases AGB stars produce s elements without lithium, and then their stellar wind will, on the contrary dilute Li and enhance Y in the observed stars.

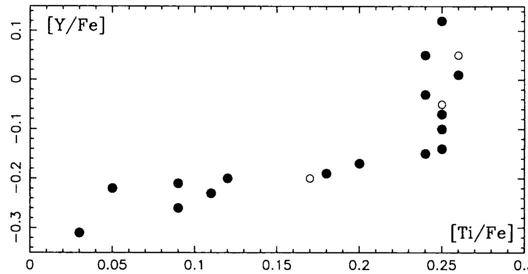

Figure 1. The first group ([Ti/Fe] < 0.23) shows a good correlation between [Y/Fe] and [Ti/Fe], the second group is Y-rich with a large Y spread. The open circles represent the stars where the lithium line could not been detected

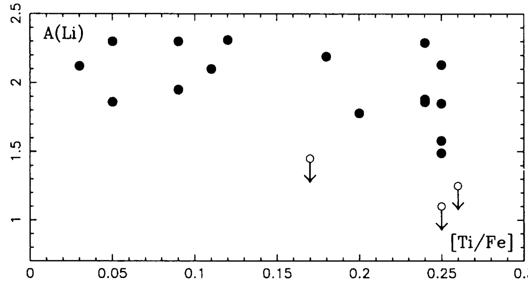

Figure 2. The first group has a rather constant Li abundance (typical of metal-poor stars), the second group ([Ti/Fe] > 0.23) has a larger spread in lithium and a lower mean abundance

We have measured the lithium abundance for 19 stars (out of the 21 stars). Most of the spectra have been obtained with FEROS at the ESO 1.5m telescope and three of them with the CFH telescope in Hawaii. The results are presented in Fig. 2 (similar to Fig. 1 but with the lithium abundance as ordinate). All these stars are dwarfs and their temperature is higher than 5700K.

The first group ([Ti/Fe] < 0.23) behaves like metal-poor stars : a rather constant Li abundance, but the second group ([Ti/Fe] > 0.23) has a larger spread and a smaller mean Li abundance suggesting an anticorrelation Li/Y by Li-dilution. But within this last group there is no clear correlation (or anticorrelation) star by star, between Y and Li. The temperature distributions in the two groups are rather similar, and thus the difference of lithium behaviour cannot be attributed to different temperature distributions. Our data do not bring a clear confirmation of the interpretation proposed by Jehin et al., the problem obviously deserves further investigation.

References

Jehin E., Magain P., Neuforge C., Noels A., Parmentier G., Thoul A. A. , 1999, A&A 341, 241