The Light Elements and Their Evolution
IAU Symposium, Vol. 198, *2000*
L. da Silva, M. Spite, J. R. de Medeiros, eds.

Lithium abundance in late-type stars

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Abstract.

We have a list of nearby bulge-like turnoff stars with metallicities in the range -0.3 $\leq$ [Fe/H] $\leq$ +0.6, for which we have the absolute magnitude from Hipparcos, Geneva photometry (therefore temperature and metallicity), and radial velocity from Coravel (Grenon 1990, 1997). From Hipparcos data, the turnoff of these field stars indicate an age of 10-11 Gyr, which would be the age of the most metal-rich component of the bulge.

We obtained high resolution échelle spectra with FEROS, with the aim to carry out detailed analysis of these stars. In this paper we present the Li abundance for 40 of these metal-rich and old dwarf stars, as a function of their temperatures.

1. Observations

We present Li abundances for a sample of turnoff metal-rich stars, which seem to be a nearby component of the Galactic bulge. The characteristics of the sample were presented in Barbuy & Grenon (1990) and Grenon (1990, 1997). The sample is divided in two subsamples: a) stars more metal-rich than [Fe/H] = +0.3 (SMR or super metal rich stars), and b) stars in the range -0.8 $\leq$ [Fe/H] $\leq$ +0.3 (BGL or bulge-like stars). The stellar parameters $T_{\rm eff}$ and [Fe/H] adopted here were deduced from Geneva photometry.

The derivation of Li abundances is carried out for 40 stars of our sample, by computing synthetic spectra compared to observed spectra of the Li doublet at λ6707.776 Å and λ6707.927 Å. The gravity was assumed to be log g = 4.5 and the microturbulent velocity ξ = 1.0 kms^{-1}. The Li abundances are almost insensitive to variations in gravity and microturbulence velocity, and the errors in estimations are dominated by the temperature uncertainties. In the figures we show the Li abundances vs. temperature for SMR stars (Fig. 1a) and for BGL and Hyades stars (Fig. 1b).

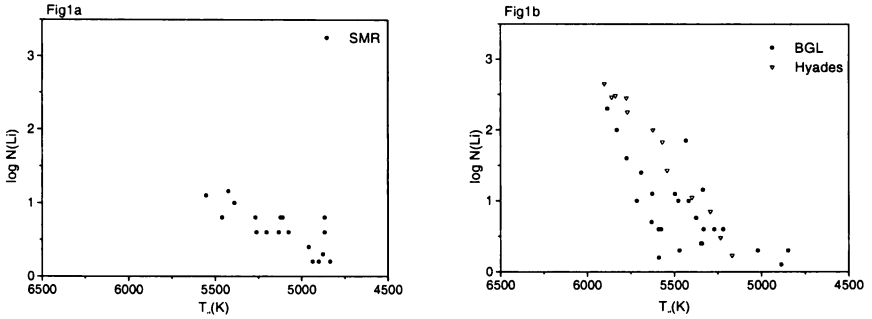

Figure 1. Lithium abundances for the SMR (Fig. 1a) and for BGL (circles) and Hyades (down triangles) stars (Fig. 1b).

2. Discussion

From Fig. 1a we note that all SMR stars are cooler than $T_{eff} < 5600K$, and have their Li abundance very depleted. Below this temperature the convective zone deepens to inner regions where lithium has been destroyed and dilution becomes important (Pilachowski et al. 1993). We found an increase from log N(Li) < 0.2 to 1.2 in the temperature range from 5000 to 5600 K.

For the less metal-rich star sample, BGL, Fig. 1b shows a large dispersion in Li abundances below 5600K. Stars hotter than this limit have a very steep increase in Li abundances with increasing temperatures. We can compare this behavior with a study of the Hyades by Cayrel et al. (1984), also shown in Fig. 1b. At similar temperatures, Hyades stars, which are younger and more metal-rich than BGL stars (700 Myr), have a higher Li abundance. The relation log N(Li) vs. T_{eff} is also steeper for the BGL stars, which agrees very well with the empirical results for the older solar-type clusters.

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https://doi.org/10.1017/S0074180900166896 Published online by Cambridge University Press