ELEMENT ABUNDANCES FROM B STARS IN THE MAGELLANIC CLOUDS[1]

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ABSTRACT. High resolution spectrograms of B stars in the blue globular cluster NGC 2004, located in the Large Magellanic Cloud (LMC), have been used to derive chemical abundances, differentially with respect to a galactic comparison star.

With échelle spectrographs and CCD detectors it has now become possible to observe spectra from only slightly evolved B stars in the Magellanic Clouds, with high signal-to-noise ratio (e.g. S/N ≈ 100). We have obtained high resolution spectra of slowly rotating early B giants (star B30 and star B15, with $V = 13.8$, $V = 14.5$, respectively) in the blue globular cluster NGC 2004 with the ESO-Cassegrain-Echelle Spectrograph (CASPEC) and the 3.6 m ESO telescope at La Silla, Chile (Jüttner *et al.* 1989). The wavelength range is 3900 Å ≤ λ ≤ 4900 Å and the resolution is about 20000. We also obtained low resolution IUE spectra (1200 Å ≤ λ ≤ 3200 Å) of both stars.

The aim of these observations is to derive chemical abundances for the elements He, C, N, O, Mg,Al, Si, S and Fe. Such data are important in connection with current evolutionary scenarios of galaxies.

Up to now, the analysis has been carried out for NGC 2004/B30, differentially to the galactic B star HR 3663, which we observed with the same instruments (CASPEC and IUE). Our second object NGC 200/B15 is currently being analysed.

The model atmosphere parameters $T_{\rm eff}$ and log g were calculated from ionisation equilibria (SiIII/SiIV and FeII/FeIII for NGC 2004/B30, HR 3663, respectively), from the continuum fit (IUE-data, UBVRI- and Stroemgren-photometry) and from the Balmer-line profiles, using the ATLAS 6 model atmosphere code. The results are shown in the following Tables 1 and 2.

Table 1. Model atmosphere parameters

Object	$T_{\rm eff}$ [K]	log g [cm/s^2]	$\xi_{\rm micro}$ [km/s]	Sp.
NGC 2004/B30	23400±500	3.3±0.1	20±5	B 1.5 III
HR 3663	17900±500	3.6±0.1	≤5	B 3 III

[1] Based on observations collected at the European Southern Observatory at La Silla, Chile and at the ESA-IUE satellite tracking station at Villafranca, Spain.

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Table 2. Stellar parameters

Object	$M/M_\odot$	$R/R_\odot$	M_v	M_{bol}
NGC 2004/B30	20.3±7.7	16.1±0.9	-5.00±0.13	-7.37±0.19

For the distance module of the LMC we used $m - M = 18.5 \pm 0.1$. We derived for the galactic B star HR 3663 practically solar abundances. For the LMC star NGC 2004/B30 we obtained a mean value for the heavier elements Mg, Al, Si, S and Fe of $\Delta \log \varepsilon = -0.7 \pm 0.2$. For C we obtained an underabundance of about a factor of 10. The derived element abundances for NGC 2004/B30 differentially to HR 3663 are given in Table 3.

Table 3. Element abundances for NGC 2004/B30

Element	Number of Lines	$\Delta \log \varepsilon = \log \varepsilon_{NGC2004/B30} - \log \varepsilon_{HR3663}$
He	7	- 0.1
C	2	- 1.2
N	6	- 0.3
O	18	- 0.5
Mg	3	- 0.5
Al	4	- 0.9
Si	3	- 0.9
S	5	- 0.6
Fe	5	- 0.6

The estimated accuracy in the element abundances is ± 0.2 dex, derived from the standard deviation of all analysed O lines, since the uncertainties in T_{eff} and log g have no significant effect on the abundances at this temperature range.

Within this accuracy both the abundances and their pattern agree with the results obtained for the blue globular cluster star NGC 1818/D12 by Reitermann *et al.* (1990). Thus we find again a surprisingly low metal abundance for a blue globular cluster star in the LMC. A more detailed article is in preparation for publication in *Astronomy and Astrophysics*.

Since the program is part of the ESO key project on "Coordinated Investigation of Selected Regions in the Magellanic Clouds", further B stars of both clouds will be analysed by our group in the future.

References

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