From Lithium to Uranium: Elemental Tracers of Early Cosmic Evolution
Proceedings IAU Symposium No. 228, 2005
V. Hill, P. François & F. Primas, eds.

doi:10.1017/S1743921305005909

Detailed abundance analysis of the bulge globular cluster NGC 6553

A. Alves-Brito[1], B. Barbuy[1], M. Zoccali[2], D. Minniti[2], S. Ortolani[3], V. Hill[4], A. Renzini[5], L. Pasquini[5], E. Bica[6]

[1]IAG-USP, Rua do Matão 1226, São Paulo, 05508-900, Brazil
email: abrito@astro.iag.usp.br

[2]Universidad Catolica de Chile, Casilla 306, Santiago 22, Chile

[3]Università di Padova, Vicolo dell'Osservatorio 2, 35122 Padova, Italy

[4]Observatoire de Paris-Meudon, 92195 Meudon Cedex, France

[5]ESO, Karl Schwarzschild Strasse 2, 85748 Garching bei München, Germany

[6]Universidade Federal do Rio Grande do Sul, CP 15051, Porto Alegre 91501-970, Brazil

Abstract. A detailed abundance analysis of four giants in the metal-rich bulge globular cluster NGC 6553 is carried out, based on optical high resolution échelle spectra obtained with UVES at the ESO VLT-UT2 Kueyen telescope. A mean radial heliocentric velocity of -1.86 km s^{-1} is found. Stellar parameters are derived from spectroscopic data based on Fe I and Fe II lines. Enhanced abundance ratios for the $\alpha-$elements Mg and Si with respect to Ca and Ti are obtained. The odd-Z elements are typically solar. A solar value for the r-process element Eu ([Eu/Fe] $= +0.05 \pm 0.06$) was also found.

Keywords. Globular clusters:individual:NGC6553 - globular clusters:general - stars:abundances

1. Introduction

NGC 6553 is the most well-studied bulge globular cluster, and nevertheless only few stars were analysed at high resolution. CCD analyses were carried out for one giant by Barbuy *et al.* (1992), and two giants by Barbuy *et al.* (1999) at moderate resolution (R∼20 000), and five red horizontal branch stars by Cohen *et al.* (1999) at high resolution (R∼34 000), whereas in the H band two giants were analysed by Origlia *et al.* (2002) at moderate resolution (R∼25 000) and five giants by Meléndez *et al.* (2003) at high resolution (R∼50 000).

In this work we present detailed abundance analysis of four giants in NGC 6553 using high resolution spectra obtained at the ESO VLT-UT2 Kueyen telescope, equipped with the UVES spectrograph.

2. Results

Elemental abundances were obtained through line-by-line spectrum synthesis calculations using the code described in Barbuy *et al.* (2003). We find a mean value of metallicity that is compatible with recent results by Cohen *et al.* (1999) and Meléndez *et al.* (2003) based on high resolution spectroscopy. The deficiencies of the $\alpha-$elements [Ca/Fe] $= -0.27$ dex and [Ti/Fe] $= -0.10$ dex, suggest a deficiency of low mass Type II Supernovae. In contrast, [Mg/Fe] $= +0.23$ dex and [Si/Fe] $= +0.16$ dex, indicate a rapid chemical evolution history dominated by Type II Supernovae in the Galactic bulge. For the odd-Z elements we find that the abundance ratios show a solar value and no correlation was found between Mg:Al results. For the heavy elements, [Zr/Fe] $= -0.72$ dex,

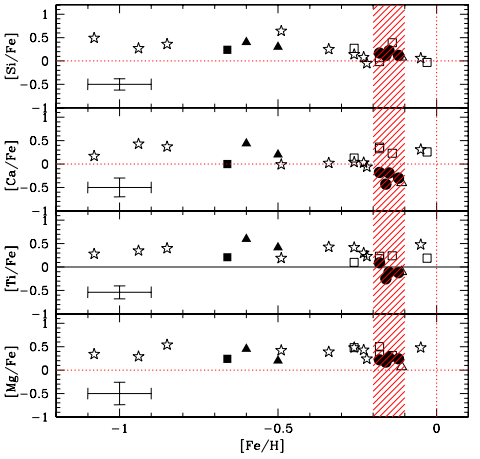

Figure 1. The symbols are for stars from: NGC 6553 in this work (*filled circles*), NGC 6553 in Barbuy *et al.* (1999) (*filled triangles*), NGC 6553 in Cohen *et al.* (1999) (*open squares*), mean value in NGC 6528 of Zoccali *et al.* (2004) (*open triangle*), mean value in 47 Tucanae of Alves-Brito *et al.* (2005)(*filled square*), and bulge field in McWilliam & Rich (1994) (*open stars*). The error bar quoted corresponds to a typical uncertainty in the mean abundance of this work.

[Ba/Fe] = −0.33 and [La/Fe] = −0.16 dex, whereas a solar value for europium, [Eu/Fe] = +0.05 dex, was found. Figure 1 displays the α-elements abundances of NGC 6553 compared to those of 47 Tucanae, NGC 6528, and bulge field stars.

Acknowledgements

AA acknowledges a FAPESP fellowship no. 04/00287-9 and the Latin American-European Network on Astrophysics and Cosmology (LENAC) of the European Union's ALFA Programme. BB acknowledges grants from CNPq and FAPESP.

References

Alves-Brito, A., Barbuy, B., Ortolani, S., *et al.* 2005, *A&A* 435, 657
Barbuy, B., Castro, S., Ortolani, S., & Bica, E. 1992, *A&A* 259, 607
Barbuy, B., Renzini, A., Ortolani, S., Bica, E., & Guarnieri, M.D. 1999, *A&A* 341, 539
Barbuy, B., Perrin, M.-N., Katz, D., Coelho, *et al.* 2003, *A&A* 404, 661
Cohen, J.G., Gratton, R.G., Behr, B.B., & Carretta, E. 1999, *ApJ* 523, 73
Cutri, R. M., Skrutskie, M. F., van Dyk, S., *et al.* 2003, *VizieR On-line Data Catalog*
McWilliam, A., & Rich, R.M. 1994, *ApJS* 91, 749
Meléndez, J., Barbuy, B., Bica, E., *et al.* 2003, *A&A* 411, 417
Origlia, L., Rich, R.M., & Castro, S. 2002, *AJ* 123, 1559
Zoccali, M., Barbuy, B., Hill, V., *et al.* 2004, *A&A* 423, 507