N in turn-off stars of NGC 6397 and NGC 6752 *

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Submitted: Accepted

ABSTRACT

Aims. Our goal is to measure the nitrogen abundance in 5 Turn Off (TO) stars of the two Globular Clusters NGC 6397 and NGC 6752, and to compare the cluster abundances with those of field stars of comparable metallicity. In addition we wish to investigate the variations of nitrogen abundance and its connections to variations in the abundances of other light elements.

Methods. We determine the nitrogen abundance from the compact band head of the (0-0) vibrational band of the NH \(A^3\Pi - X^1\Sigma^-\) system at 3360 Å, using spectra of resolution R\( \sim 45000 \) obtained with the UVES spectrograph on the ESO Kueyen-VLT 8.2m telescope, analysed with spectrum synthesis based on plane parallel LTE model atmospheres. We apply the same method previously used on field stars, to allow a direct comparison of the results.

Results. Nitrogen is found to have the same abundance in two of the NGC 6397 stars, in spite of a difference of one order of magnitude in oxygen abundance between them. In a third star of the same cluster, the value is slightly lower, but compatible with the other two, within the uncertainties. All the stars in NGC 6397 are N-rich with respect to field objects of similar metallicity. The two stars in NGC 6752 show a difference in nitrogen abundance by over one order of magnitude. The same stars differ in the abundances of other elements such as Na, O and Li, however only by a factor \( \sim 3-4 \).

Conclusions. NGC 6397 and NGC 6752 are, at present, the only two globular clusters in which N has been measured in TO stars in a way consistent with similar measurements in field stars. The behaviour of N is different in the two clusters: no variation is observed NGC 6397, while a large variation is observed in NGC 6752. This is consistent with a picture in which the stars in NGC 6752 have been formed by a mixture of “pristine” material and material which has been processed by an early generation of stars, referred to as “polluters”. The N abundances here reported will help to constrain the properties of the polluters. In the case of NGC 6397 a simple pollution history is probably not viable, since the observed variations in O abundances are not accompanied by corresponding variations in N or Li.

Key words. Stars: abundances – stars: globular clusters – NGC 6397, NGC 6752 –stars: formation

1. Introduction

In spite of the fact that nitrogen is one of the most abundant elements in the cosmos, only recently it has been possible to produce large samples of N abundances in metal poor stars, enabling us to quantitatively study its evolution in the Galaxy (see e.g. Israeli et al. 2004, and references therein). Nitrogen tracks iron ([N/Fe] \( \sim 0 \)) down to a metallicity of \( \sim -1.0 \). The evolution at lower metallicity is less clear; while many stars seem to indicate that N continues to track iron, a few field stars are found to be nitrogen-rich (the prototypes of the class being HD 74000 and HD 160617 Bessell & Norris[1982], while others seem to show [N/Fe] ratios below solar. In their investigation of the chemical composition in the lowest metallicity stars Spite et al. (2005) suggested that a possible interpretation of the data in the metallicity range \( -4.0 \leq [\text{Fe/H}] \leq -2.5 \) is a bimodal distribution of nitrogen abundances, the majority of stars at [N/Fe] \( \sim +0.4 \) and the rest at [N/Fe] \( \sim -1.0 \). Given the complexity of its nucleosynthesis, iron is not the best reference element to study chemical evolution, as discussed in Cavarel et al. (2004), and an \( \alpha \)-chain element such as O or Mg is preferable. The [N/Fe] ratio begins to decline as one moves from solar to lower metallicities (see e.g. figure 17 of Spite et al. 2005) and at low metallicities it reaches a constant value, a plateau at [N/Fe] \( \sim -0.9 \), although it could be argued that there are in fact two plateaus, the second found around [N/Fe] \( \sim -1.4 \).

From the nucleosynthetic point of view there is only one mode of nitrogen production: it is formed in the course of the CNO cycle, at the expenses of available C and O. Since this requires the pre-existence of nuclei of C and O, one may expect the production of N to increase with increasing abundance of C and O, i.e. with metallicity. Nitrogen would then be a so-called purely secondary element, to distinguish it from primary elements, like the \( \alpha \)-chain elements, whose yield is independent of metallicity. The ratio of a purely secondary element to a primary one should be a monotonically increasing function of metallicity. The fact that [N/Fe] shows a plateau at low metallicity demonstrates that N cannot be a purely secondary element. We note here that although the concept of primary and secondary elements is a useful simplification, for the majority of the elements the production history is complex enough that it is inappropriate to label it with either of these terms.

For nitrogen, although the nucleosynthetic process is unique, it is necessary to invoke different sites where the process occurs to explain the two kinds of behaviour. Intermediate mass stars in
the AGB phase (IM-AGB stars, Ventura et al. 2002), in which the H-burning shell operates through the CNO cycle, have always been considered major producers of nitrogen. For these stars the necessary C and O nuclei are those already present at the time of the formation of the star and the production mode would be secondary. Massive stars are other possible N producers. In such stars the central H burning takes place through the CNO cycle, and again the mode of production would be secondary. If, however, the star is rotating, as soon as the central He burning is ignited, fresh C and O produced in the core may be transported through rotational mixing to the H-burning shell. This would then produce N in a primary fashion, since the necessary parent nuclei are created in situ (see Maeder and Meynet (2005) for a complete discussion). In such a scenario N production cannot be purely primary, since some secondary production is unavoidable. A primary mode of production of N may occur also in IM-AGB stars, provided a way of mixing the products of the He burning shell to the H burning shell exists.

The two above-mentioned producers (IM-AGB stars and massive stars) release their nucleosynthetic products, which become available for the next generation of stars, on quite different time-scales. Massive stars will explode as core-collapse supernovae on time scales shorter that 10 Myr, while IM-AGB will release their products through winds or in the planetary nebula phase on a time scale between 300 Myr and 1 Gyr, depending on their mass and metallicity.

The pattern of N abundances in Globular Clusters is somewhat more complex than in field stars. In the first place, like other light elements, N displays sizeable star to star scatter within the cluster. From studies conducted with intermediate band photometry or low resolution spectra it has been clear that many clusters display variations of N abundances (see Kraft 1979, for a review of these older results). For many years such effects were supposed to be caused by mixing in the giant stars, which were the only ones it was possible to analyse (see Norris 1981, for an interesting idea on the role of rotation). In the recent years, largely thanks to advent of 8m class telescopes, it has been possible to investigate these effects down to the TO of a few Globular Clusters, and the abundance variations appear to persist. Since a TO star is not expected to experience mixing, this calls for another explanation for these variations (Carretta et al. 2005). Although it is generally accepted that the stars we presently observe in GCs have been formed out of material which has been inhomogeneously polluted by a previous generation of stars, there is little consensus on which stars were responsible for the pollution. Proposed candidates are IM-AGB stars (D’Antona et al. 2005) and massive stars (see e.g. Decressin et al. 2007a), including Wolf-Rayet objects (Smith 2006).

It seems therefore timely to compare the N abundance observed in unevolved field and Globular Cluster stars, by making the effort to place them on the same abundance scale, and to use this comparison to shine some light on the formation of nitrogen in the Galaxy and on the formation process of Globular Clusters and on the Globulars - Halo relationship.

We here present abundances for five TO stars (3 in NGC 6397 and 2 in NGC 6752) derived from the compact band head of the (0-0) vibrational band of the NH $A^1Π - X^3Σ^-$ system at 3360 Å. This feature is stronger than the UV CN bands used in (Carretta et al. 2005) and should provide a more accurate measurement. Moreover the N abundance derived from the NH bands does not depend on either C nor O, instead when we use the CN bands the derived N abundance depends on the assumed C and O abundances. The O abundance enters because the majority of C atoms is always locked in the tightly bound CO molecule. For four out of the five stars of our sample preliminary abundances based on the NH bands have been presented in Pasquini et al. (2004, 2007), however we deemed necessary a reanalysis using the same molecular data and analysis procedure as in Euvillon et al. (2004) and Israeli et al. (2004), to allow an unambiguous comparison of the N abundances in the GCs with those in field stars of comparable metallicity.

2. Sample Stars and Observations

Being the closest GCs in the southern hemisphere, NGC 6397 and NGC 6752 are amongst the most studied GCs. Many high resolution spectra exist, also of TO stars.

The objects and the observations presented here have been described in Pasquini et al. (2004, 2007). Only star 1406 of NGC 6397 was not contained in the Pasquini et al. (2004) sample, because the S/N ratio obtained in the Be region was too low to attempt any Be abundance analysis.

The spectra discussed in this paper are only the ones taken with the blue arm of the UVES spectograph (Dekker et al. 2000) on the ESO Kueyen-VLT 8.2m telescope. An identical setting was used in the observations of the two Globular Clusters: central wavelength 3460 Å, 1″0 slit and 2 × 2 on-chip binning. The effective resolution was around R ~ 45 000. Further details can be found in in Pasquini et al. (2004, 2007).

The two stars of NGC 6752 were selected at the extremes of the O-Na anti-correlation from Gratton et al. (2001): star 4428 is representative of the O-rich, Li rich component, while star 200613 is representative of the O-poor - Li poor component. By observing stars at the extremes of the chemical distribution, we aimed at maximising the chances of observing possible differences in N abundance.

Table 1 summarises the characteristics of the stars, including the abundances of the single elements, as derived from the literature. The [N/H] as derived in the present work is also given, in the last column. The stellar parameters listed in Table 1 are those adopted in our spectroscopic analysis. Only abundances of those elements which are known to vary from star to star (O, Na, Li, N) are listed in Table 1. The reader can find additional element abundances in the quoted papers: G01, James et al. (2004), and Carretta et al. (2005).

3. Abundance analysis

The main aim of this paper is to set the cluster stars on the same N abundance scale as field stars (Israelian et al. 2004, Euvillon et al. 2004). We therefore used exactly the same line fitting method, molecular and atomic line data as Euvillon et al. (2004). The model atmospheres where the same used in Pasquini et al. (2004, 2007) and were computed with version 9 of the ATLAS code (Kurucz 1993, 2005). For its Linux version Sbordone et al. (2004) Sbordone (2005). All the models were computed with the “NEW” Opacity Distribution Functions (Castelli & Kurucz 2003), with 1 km s$^{-1}$ micro-turbulence, a mixing-length parameter $\alpha_{MLT}$ of 1.25 and no overshooting. The synthetic spectra were computed with the line formation code MOOG (Sneden 1973, 1974, 2007).

Figures [1] and [2] show the spectra of the five stars compared to synthetic spectra. The synthetic spectrum with the best fit N abundance is always shown as a solid line.

The stellar parameters adopted are given in Table 1. A difference in T$\text{eff}$ of ±100 K implies a change in [N/H] of ±0.09dex.
Table 1. NGC 6752 sample stars, their atmospheric parameters and abundances. The atmospheric parameters, [Fe/H], [O/H] and [Na/Fe] are from Gratton et al. 2001; Log(Li/H) from Pasquini et al. (2005), and [Be/H] from Pasquini et al. 2006, [N/H] from this work.

| Star | Teff | log g | [Fe/H] | [O/H] | [Na/Fe] | log(Li/H) | log(Be/H) | [N/H]  |
|------|------|------|--------|-------|---------|-----------|-----------|-------|
| 4428 | 6226 | 4.28 | -1.52  | -1.28 | -0.35   | 2.50      | -12.04    | -1.2 ± 0.1 |
| 200613 | 6226 | 4.28 | -1.56  | /     | 0.64    | 2.13      | < -12.2   | 0 ± 0.1  |

Table 2. NGC 6397 stars, their atmospheric parameters and abundances. The atmospheric parameters, are from Bonifacio et al. (2002), [Be/H] from Pasquini et al. 2004, [N/H] from this work.

| Star | Teff | log g | [Fe/H] | [O/H] | [Na/Fe] | log(Li/H) | log(Be/H) | [N/H]  |
|------|------|------|--------|-------|---------|-----------|-----------|-------|
| 2111 | 6207 | 4.1  | -2.01  | -2.24 | +0.17   | 2.33      | -12.27    | -0.76 ± 0.1 |
| 228  | 6274 | 4.1  | -2.05  | -1.64 | +0.16   | 2.28      | -12.43    | -0.75 ± 0.15 |
| 1406 | 6345 | 4.1  | -2.04  | /     | /       | 2.37      | /         | -1 ± 0.2 |

In spite of the differences in atomic and molecular data involved, and of the line formation code used, the comparison between the present results and those of Pasquini et al. (2004, 2007) is excellent (agreement to better than 0.05 dex), except for star 4428 of NGC 6752, for which there is a discrepancy of a factor of two. In spite of this discrepancy we confirm the huge abundance difference (1.3 dex) between the two observed stars of this cluster.

Carretta et al. (2005) used in their analysis the CN band at 3880 Å to derive N in several stars in GCs. For all the dwarfs in NGC 6397 they found only upper limits, higher (therefore consistent) than our measurements. As far as the NGC 6752 dwarfs are concerned, they quote a similar value to ours for star 200613, the value 10 times higher quoted for star 4428 in that paper, should instead be considered as an upper limit (E. Carretta private communication, see also Pasquini et al. 2007).

4. Discussion

4.1. Comparison with field stars

Our N abundances for GC stars can be consistently compared to the results for field stars of Ecuvillon et al. (2004) and Israelian et al. (2004).

Figure 3 shows the [N/H] abundance vs. [Fe/H] for field and cluster stars. Most field stars closely follow a 1:1 relationship, with a scatter compatible with the error measurements (quoted as ± 0.15 by Israelian et al. 2004 and given as a reference in the upper left corner of the Figure). The [N/O] ratio is shown in Fig. 4 for the present discussion we ignore the possible complications arising from the fact that the O abundances displayed have been derived in an inhomogeneous way and using different O indicators, and take all measurements at face value. With the caveat that any systematic differences between the different analysis will tend to blur any existing pattern. Two points emerge from Figure 2:

1. The cluster stars do not resemble, in general, the behaviour of the field stars.
2. The two clusters do not show the same behaviour.

The first point is somewhat expected, since we have known for long time of the presence of chemical anomalies in GC stars, which includes the presence of N rich stars. N rich stars, though known in the field, are extremely rare, and a typical sample, like the one of Israeli et al. (2004), contains at most one such object.

The two NGC 6752 stars show a large spread in N (almost a factor of 20) and the cluster stars, including all stars observed in NGC 6397, have a very high N abundance, clearly departing from the field stars relationship at high significance. This is clearly related to the peculiar formation mechanism of GCs, and we will come back on this point in the next section.

As far as the second point is concerned we believe that this aspect should be considered with some attention, since it has not been explored too much so far. For this reason we look at the two clusters separately.

NGC 6752 is a cluster showing all possible chemical inhomogeneities and anticorrelations. But, in its anomalies, the observed trends are extremely consistent. The difference of a factor ~20 in N among the two stars is very high, but it is in line with the other large differences recorded for them in Na (factor 10) and Li (factor 2.5 ) in these stars and in oxygen (factor 4) in other stars having abundance pattern similar to star 200613 (in 200613 O has not been measured).

With our new value, the N of star 4428 is higher, but formally compatible with the field stars having similar metallicity. Even if we do not know how this GC formed, the observations are compatible with the idea that star 4428 is the prototype of an ‘unpolluted’ star, perfectly similar in all aspects to its field counterparts of similar [Fe/H], while star 200613 is, at the opposite, the prototype of highly polluted star, with high N, high Na, low Li and low O, showing therefore the signature of gas which experienced high temperatures where nuclear cycles such as CNO, Ne-Na, and the consequent Li destruction, have occurred.

When plotting N vs. O (Fig. 4), the situation is similar, unfortunately we have O abundances only for 3 out of five stars. The impression is that the cluster stars (including star 4428) stand definitely out of the field relationship. This may be related to the fact that star 4428 has an O/Fe ratio which is lower, by roughly a factor of 2, than field stars of the same [Fe/H], when N is plotted against [Fe/H] star 4428 follows the trend of field stars, but when plotted against oxygen it appears to have too much nitrogen, with respect to field stars with the same [O/H]. Clearly in a cluster like NGC 6752, which has a very strong Na-O anticorrelation, it is difficult to tell which is the "unpolluted" oxygen content of the cluster. Among the stars analysed by Gratton et al. (2001) there is one dwarf and two subgiants which have higher [O/H] than star 4428. We have chosen star 4428 as template of the “unpolluted” population, because it is the star with the lowest [Na/Fe]. New measurements of N, based on the NH bands for all the stars observed by Gratton et al. (2001), would be de-
Fig. 1. UVES spectra of the NGC 6397 TO stars in the NH band. Best fit models are shown in bold, while models varying by ±0.3 dex in NH are shown as dashed and dotted lines.

Fig. 2. UVES spectra of the NGC 6752 TO stars in the NH band. Best fit models are shown in bold, while models varying by ±0.3 dex in NH are shown as dashed and dotted lines.

The NGC 6397 cluster stars are on the other hand more intriguing: the NGC 6397 objects have very similar N abundance, with a negligible spread, but at an absolute level about 10 times higher than field stars of similar metallicity. It is not possible, even taking the highest rate of rapid rotating massive stars, to insert such a high N production into a standard Galactic chemical evolutionary model (see e.g. Chiappini et al. 2006), thus such a high N is the direct proof that the NGC 6397 stars have been affected by a peculiar process. In their extensive study of the Globular Cluster system of M 31, Burstein et al. (2004), using integrated light spectra, have shown that the older clusters of M 31 have considerably stronger NH bands than Galactic clusters. The reasons for this difference is unclear. NGC 6397 is not among the Galactic Globular Clusters considered by Burstein et al. (2004), but adopting the naive point of view that NH band strength is related to N abundance, one may expect that NGC 6397 in integrated light should show a stronger NH band than other Galactic Globular Clusters, although not necessarily as strong as that of the M 31 clusters. It remains to be investigated if the mechanism which causes a strong NH band in the Clusters of M 31 is the same, or akin to, that which causes the high N abundance in NGC 6397.

The oxygen content of the cluster is, on the opposite, very low; at least a factor of two lower than the field stars of similar
metallicity. Even if the behaviour of oxygen in metal poor stars is highly debated, oxygen has been found at the level of only $[\text{O}/\text{Fe}] = 0.2-0.3$ in NGC 6397 by all authors (Thévenin et al. 2001, Pasquini et al. 2004, Gratton et al. 2001). Carretta et al. 2005 show that the C in NGC 6397 is at a level of $[\text{C}/\text{Fe}] \sim 0$, which is very similar to what is observed in field stars of similar metallicity. This clearly indicates that for the dwarfs observed in this cluster the whole CNO balance is different to that of field stars. The Li abundance (Molaro & Pasquini, 1994, Pasquini & Molaro 1996, Thévenin et al. 2001, Bonifacio et al. 2002, Korn et al. 2006) is, on the other hand, absolutely consistent with the Spite plateau (Spite & Spite 1982a,b), and Na, with a slightly supersolar value, does not vary at a significant level in the stars so far observed (Gratton et al. 2001).

As far as the chemical composition of the TO stars is concerned, the homogeneity in NGC 6397 stars seems much higher than in NGC 6752, in that only a large difference of oxygen has been reported by Pasquini et al. (2004) for two stars of this sample, while no substantial spread is observed in any other element among the main sequence stars. Only three subgiants show evidence for strong Na and N variations and no real ‘anticorrelation’ can be deduced by the abundances so far published (Gratton et al. 2001, Carretta et al. 2005, Table 1).

Of course we must be careful in deriving strong conclusions from such a low statistics, and we are aware that some of the previous evidences (or missing evidences) could be simply the result of a combination of a limited sample and large errors, however, we think we may summarise this part of the discussion saying that, in spite of some similarity, the two clusters show a different behaviour with respect to their N content and, in general, the spread of light elements amongst their stars: while the NGC 6752 stars abundances show consistent signatures of pollution, the NGC 6397 stars show at the same time the signatures of CNO (and likely NeNa) processed material, while showing at the same time no clear anticorrelation, a much larger homogeneity in abundances, and a Li content similar to the Spite plateau.

### 4.2. About GC formation

One fundamental consideration in the discussion of the formation scenarios is the fact that anti-correlations persist in evolved stars after the dredge-up (see e.g. Grundhal et al. 2002). This shows that the whole stellar mass, and not only the external stellar layers, is affected by the chemical anomalies.

As far as this paper is concerned, we may summarise the ongoing discussion on the formation of GC in two main points:

- The mass of the “polluting” stars: broadly speaking some groups advocate that the CNO cycling has been produced by intermediate mass AGB stars (Ventura et al. 2002, D’Antona et al. 2005), while others favour massive rotating stars (Maeder and Meynet 2002, Decressin et al. 2007b). Each of these schemes has strong and weak points. In an attempt to summarise them, we can say that IM-AGB stars have the advantage of being ‘natural’ N producers, able to also produce Li (and explain the behaviour of NGC 6397 through the so called Cameron-Fowler mechanism; Cameron & Fowler, 1971), but having at present two main problems: the difficulty of reproducing the observed yields for other elements (in particular Na), the fact that for NGC 6397 a natural conspiracy should have produced an ad hoc amount of Li, exactly the same observed in the Spite plateau (Bonifacio et al. 2002). Finally, the IM-AGB hypothesis would require a very peculiar IMF, heavily flat-topped (Prantzos and Charbonnel 2005, Chiappini et al. 2006). As far the rotating massive hypothesis is concerned, this scheme mitigates the IMF requirements, and can better explain some of the ob-
served yields, although even the most extreme models cannot account for the observed high range of the Mg-Al correlation, unless some of the employed nuclear cross-sections are affected by large errors (Decressin et al. 2007b).

One important conclusion of both hypotheses is that the “polluted” stars should have a much higher $^4$He abundance. Higher $^4$He abundance is claimed to be observed in one of the Main Sequences of $\Omega$ Cen (Piotto et al. 2005) and of NGC 2808 (Piotto et al. 2007), it would naturally explain the blue extension of HB in NGC 6752 and other clusters (D’Antona et al. 2005). On the other hand, a substantially higher $^4$He abundance, should spectroscopically produce an apparent higher abundance of heavier elements and higher spectroscopic gravity in $^4$He rich stars (Böhm-Vitense 1979). A spread in He abundances, should bring about a spread in the abundances of all elements, including iron-peak elements. The results of Gratton et al. (2001) in NGC 6397 and NGC 6752 exclude any significant spread in Fe abundances in either cluster.

– The second open issue is related to the overall mass of the structures containing the contaminants. Most analysis have so-far analysed self-pollution, that is, that all the polluted material was created within the cluster. New schemes consider the possibility of infall from the exterior (e.g. Bekki et al. 2007). In this scheme, for instance, GCs are the remnants of the core of much more massive dwarf galaxies, receiving processed gas from the whole galaxy, rather than from its own stars only. This scheme would greatly mitigate the quest for anomalous IMF, but , on the other hand, it opens the parameter space , since a new variable (the infall of material) is now added, and it has not been looked in detail as far as chemical evolution is concerned.

We shall finally recall that most attempts aim to explain all the data observed in the different GC within a unique scheme. This is , of course, a very ambitious and valuable approach, but we would like to point out that the observational data show that different clusters present a different behaviour, and therefore, the attempt to unify all observations in a unique scheme might be premature.

The measured abundances give us the possibility of studying the composition of the polluting gas in some detail. For NGC 6752 we can safely assume that the two stars observed are at the extremes of the chemical distribution of the stars in the cluster.

In order to analyse pollution, Li is the best element to be considered, since it is destroyed at the temperatures where CNO cycling occurs. The difference of Li between the two stars is of a factor about 2.5. If no Li production has occurred, this implies a fraction of 60% of processed material in the contaminated star. The observed N enhancement would imply a 25-fold N production from pristine material, that is, that all the polluted gas is now added, and it has not been looked in detail as far as chemical evolution is concerned.

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Smith, G.H. 2006, PASP, 118, 1225
Sneden, C. A. 1973, Ph.D. Thesis,
Sneden, C. 1974, ApJ, 189, 493
Sneden, C. 2007, http://verdi.as.utexas.edu/moog.html
Spite, M., & Spite, F. 1982, Nature, 297, 483
Spite, F., & Spite, M. 1982, A&A, 115, 357
Spite, M., Cayrel, R. et al. 2005, A&A 430, 655
Thévenin, F., Charbonnel, C., de Freitas Pacheco, J. A. et al. 2001, A&A, 373, 905
Ventura, P., D’Antona, F., Mazzitelli, I. 2002, A&A, 393, 215