# PRELIMINARY ABUNDANCE ANALYSIS OF 9 SUBDWARFS

T.V. Mishenina, T.I. Gorbaneva, L.E. Kantsen

Astronomical Observatory, Odessa National University
T.G.Shevchenko Park, Odessa 65014 Ukraine, *tamar@deneb.odessa.ua*

ABSTRACT. We provide parameter and abundance determination of 9 subwarfs including two SMR stars (HD 161797 and HD 182572). These stars show metallicity overabundance in agreement with previous results. Further we plan to carry out the detailed analysis of luminosity, evolutionary status, age and belonging of studied stars to spatial structures of the Galaxy.

**Key words**: Stars: abundances; stars: subdwarfs.

**Table 1.** Basic characteristics of the program stars

| HD | V | $B-V$ | $T_{\rm eff}$ | log g | $V_t$ | Sp |
|---|---|---|---|---|---|---|
| 161797 | 3.42 | 0.75 | 5750 | 3.87 | 1.3 | G5IV |
| 182572 | 5.17 | 0.76 | 5580 | 4.22 | 1.0 | G8IV |
| 188512 | 3.17 | 0.86 | 5250 | 3.14 | 1.4 | G8IV |
| 191026 | 5.38 | 0.85 | 5300 | 3.49 | 1.4 | K0IV |
| 196755 | 5.07 | 0.70 | 5680 | 3.54 | 1.4 | G5IV |
| 198149 | 3.41 | 0.91 | 5150 | 3.19 | 1.2 | K0IV |
| 216385 | 5.45 | 0.47 | 6400 | 3.97 | 1.4 | F7IV |

## 1. Introduction

The stars showing metal abundances far larger than solar one were found by Spinrad & Taylor (1969) and named the super metal rich (SMR) stars. Till now this rather small group of stars attracts attention of many researchers because the properties of metal-rich are important for interpretation of metal- rich stellar populations, such as the Buldge and their possible connection with extra-solar planets. Taylor (1996) made a critical appraisal of published values of the metallicity [Fe/H] of stars and the status of SMR star (with 95% confidence) was confirmed only for seven dwarfs and subdwarfs including the subgiant 31 Aql (HD 182572). Malagnini et al. (2000) analyzed a sample of 91 bright stars in the solar vicinity and found that 73 stars of their sample correspond to Taylor's (1996) criterion ([Fe/H]$\geq$0.2 dex). The goal of our work is comparative analysis of two SMR subdwarfs HD 161797 (Malagnini et al. 2000) and HD 182572 (Taylor 1996) with another subdwarfs. We study the chemical composition and physical parameters of 7 subdwarfs by using model atmosphere and spectra with a high dispersion and a high signal-to-noise ratio.

## 2. The observations and reduction

The investigated spectra are part of the library collected at the Haute Provence Observatory (Soubiran et al. 1998) and they were obtained with the 193 cm telescope equipped ELODIE spectrometer (R=42000). The spectral range is 4400–6800 ÅÅ, signal-to- noise ratios are more than 100. Spectra were previously reduced (Katz et al. 1998), the further processing of spectra (continuum level location, measuring of equivalent widths etc.) was carried out by us using the DECH20 software (Galazutdinov 1992). Equivalent widths EWs of lines were measured by means of a Gaussian fitting.

## 3. Parameter determination

The basic characteristics and atmospheric parameters of studied stars are listed in Table 1.

As the first approximation for $T_{\rm eff}$ we took the $T_{\rm eff}$ derived in the paper of Soubiran et al. (1998). Then, $T_{\rm eff}$ were specifayed from the condition that the abundances obtained from individual Fe I lines must be independent of the excitation potential Elow. The gravities log g have been determined through the ionization equilibrium by forcing Fe II lines to yield the same total Fe abundances as Fe I lines. Microturbulent velocities $V_t$ were determined by forcing the abundances determined from individual FeI lines to be independent of equivalent width The precision of parameter determination is $\Delta$ $T_{eff}$ = $\pm$100 K; f $\Delta$ $log$g=$\pm$0.3; $\Delta$ $V_t$=$\pm$0.2 km s$^{-1}$, respectively.

## 4. Abundance determination

The abundance analyses presented in this paper were carried out using WIDTH9 code by Kurucz. Appropriate models for each star were derived by means of standard interpolation within the grid of atmosphere models by Kurucz (1993). The choice of model on metallicity was done with accuracy of $\Delta$ [Fe/H] $\pm$0.25. The oscillator strengths log gf were taken from Gurtovenko & Kostyk (1989). The stellar abundance derived in this study are summarized in Table 2.

**Table 2.** Abundance of the program stars

| Element | HD 161797 | HD 182572 | HD 188512 | HD 191026 | HD 196755 | HD 198149 | HD 216385 |
|---|---|---|---|---|---|---|---|
| OI | 8.94 | | 8.74 | | | | |
| NaI | | 6.96 | 6.24 | 6.54 | 6.47 | 6.44 | 6.20 |
| MgI | | 8.00 | | | | | |
| AlI | 6.89 | 6.91 | 6.46 | 6.77 | 6.65 | 6.57 | 6.25 |
| SiI | 7.95 | 8.05 | 7.42 | 7.61 | 7.70 | 7.61 | 7.51 |
| SiI I | | 7.58 | | | | | |
| CaI | | 6.84 | | | | | |
| ScI | | 3.29 | | | | | |
| ScI I | 3.45 | 3.43 | 2.82 | 2.97 | 3.10 | 3.10 | 2.99 |
| TiI | 5.41 | 5.42 | 4.96 | 5.17 | 5.06 | 5.11 | 4.96 |
| TiI I | 5.18 | 5.32 | 4.75 | 4.95 | 5.01 | 4.95 | 4.99 |
| VI | 4.41 | 4.32 | 3.96 | 4.19 | 4.11 | 4.13 | 4.03 |
| CrI | 7.44 | 6.10 | 6.52 | 6.33 | 6.15 | 6.35 | 6.13 |
| CrI I | | 6.08 | | | | | |
| MnI | | 6.27 | | | | | |
| FeI | 7.97 | 7.98 | 7.45 | 7.60 | 7.66 | 7.58 | 7.52 |
| FeI I | 7.83 | 7.90 | 7.26 | 7.44 | 7.62 | 7.48 | 7.54 |
| CoI | | 5.36 | 5.27 | 5.56 | 5.04 | 5.52 | 5.14 |
| NiI | | 6.65 | 6.01 | 6.16 | 6.26 | 6.17 | 6.12 |
| CuI | | 5.27 | | | 4.68 | | 4.59 |
| ZnI | 5.35 | 5.17 | | 4.78 | 4.47 | 4.50 | 4.33 |
| SrI | 3.03 | 3.29 | 2.58 | | | | |
| YI | 2.60 | 2.99 | | 2.41 | 2.37 | 2.44 | |
| YII | 2.46 | 2.44 | | 2.10 | 2.29 | 2.90 | 2.26 |
| ZrI | | 3.01 | | 2.74 | | | |
| ZrI I | | 3.57 | | | | | |
| RuI | | 3.01 | | | | | |
| BaI I | 2.33 | 2.32 | 1.91 | 1.91 | 2.20 | 2.20 | 2.4 |
| LaI I | 1.23 | 1.16 | 0.95 | | | | |
| CeI I | 1.88 | 1.83 | 1.61 | | | | |
| PrI I | 1.02 | 1.01 | | 0.73 | | 0.78 | |
| NdI I | | 1.56 | 1.40 | 1.47 | 1.63 | 2.12 | 1.5 |
| SmI I | | 1.80 | | | | | |
| EuI I | | 3.84 | 0.38 | | | | |

## 5. Discussion

HD 161797 and 182572 show slight overabundance in agreement with previous results (Taylor 1996; Mishenina 1996; Malagnini et al. 2000). Further we plan to carry out the detailed analysis of luminosity, evolutionary status, age and belonging of studied stars to spatial structures of the Galaxy.

## References


Galazutdinov G.A.: 1992, *Preprint SAO RAS*, **92**, 27

Gurtovenko E.A., Kostyk R.I.: 1989, *Fraunhoffer spectrum and system of solar Oscillators strengths*, Naukova Dumka, Kiev, 200p.

Katz D., Soubiran C., Cayrel R., Adda M., Cautain R.: 1998, *As.Ap.*, **338**, 151

Kurucz R.L.: 1993, *CD ROM* **n13**

Malagnini M.L., Morossi C., Buzzoni A., Chavez M.: 2000, *PASP*, **112**, 1455

Mishenina T.V.: 1996, *As.Ap.Suppl.*, **119**, 321

Soubiran C., Katz D., Cayrel R.: 1998, *As.Ap.Suppl.*, **133**, 221

Spinrad H., Taylor B.J.: 1969, *Ap.J.*, **157**, 1279

Taylor B.J. 1996, *Ap.J.Suppl.*, **102**, 105.