ABUNDANCES OF N - CAPTURE ELEMENTS IN STARS OF THIN AND THICK DISKS.

T.V. Mishenina[1], T.I. Gorbaneva[1], N.Yu. Basak[1],C. Soubiran[2], V.V. Kovtyukh[1]

[1] Astronomical Observatory, Odessa National University
T.G.Shevchenko Park, Odessa 65014 Ukraine, *astro@paco.odessa.ua*

[2] Observatoire Aquitain des Sciences de l'Univers
CNRS UMR 5804, BP 89, 33270 Floirac, France

ABSTRACT. Abundances of neutron-capture (n-capture) elements in the stars belonging to thin and thick disks are obtained. The separation of thin and thick stars on kinematic criterion was made early. The spectra were obtained with the ELODIE spectrograph at the 1.93-m telescope of the Observatoire de Haute Provence (France). The determination of elemental abundances was carried out in LTE assumption by model atmosphere method, for Ba and Eu taken into account the hyperfine structure. The dependences of n-capture element abundances on metallicity for thin and thick disks are presented.

Key words: Stars: fundamental parameters; stars: abundances abundances:n-capture elements, r-, s-process

1. Introduction

The behavior of n-capture elemental abundances in the thin and thick is very important for the investigation of the galactic disks evolution. The different sources of r-, s- process brings the different contribution in enrichment of ISM by these elements. The change of the slope of [El/Fe] vs. [Fe/H] in the thin relatively TO thick disk may characterize the change of contribution (in %, for example) from different sources to the two substructures. In this paper we present the abundance determination of Y, Zr, Ba, La, Ce, Nd, Sm, and Eu and the analysis of abundance trends.

2. Observations and parameters.

The spectra of studied stars were obtained on 1.93 m telescope of the Observatoire Haute Provence (France) equiped with echelle-spectrograph ELODIE. A resolving power is 42000, the wavelength range is 3850-6800 ÅÅ. Spectrum extraction, wavelength calibration and radial velocity measurement have been performed at the telescope with the on-line data reduction software while straightening of the orders, removing of cosmic ray hits, bad pixels and telluric lines were performed as described in Kats et al. (1998). The continuum level drawing and equivalent width measurements were carried out by us using DECH20 code Galazutdinov (1992). Equivalent widths of lines were measured by Gaussian function fitting. The temperatures were determined with the very high level of accuracy using the line depth ratios. The surface gravity log g was determined using the iron ionization equilibrium assumption, where the average iron abundance determined from FeI lines and Fe II lines must be identical. Microturbulent velocities $V_t$were determined by forcing the abundances determined from individual FeI lines to be independent of equivalent width. The parameters determination and the separation of thin and thick stars on kinematic criterion was made early (Mishenina, 2004).

3. Elemental abundances

Using the derived stellar parameters and the atmosphere models of Kurucz (1993) we determined the elemental abundances of Y, Zr, La, Ce, Nd, and Sm from an LTE analysis of equivalent widths using the WIDTH9 code. Oscillator strengths for lines have been taken from Kovtyukh & Andrievsky (1999). Ba and Eu abundances are determined from the BaII resonance line 4555 Å, and from the EuII subordinate line 6645 Å, by line profile fitting of the stellar spectra calculated spectra by the STARSP code (Tsymbal, 1996). BaII and EuII ions considered here have the lines that show appreciable hyperfine structure (hfs). The atomic data for these lines were taken from Mashonkina & Gehren (2000). Recent NLTE calculation for BaII and EuII have been carried out by Mashonkina & Gehren (2000) and Mashonkina et al (1999). They have shown that for the line Ba

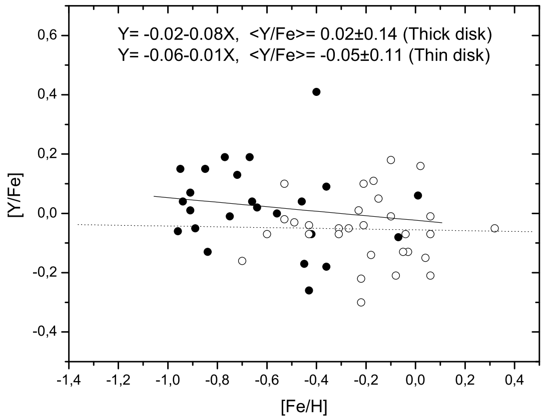

Figure 1: The run of [Y/Fe] with [Fe/H]. Thick disk stars are marked as filled circles, and thin disk stars as open circles.

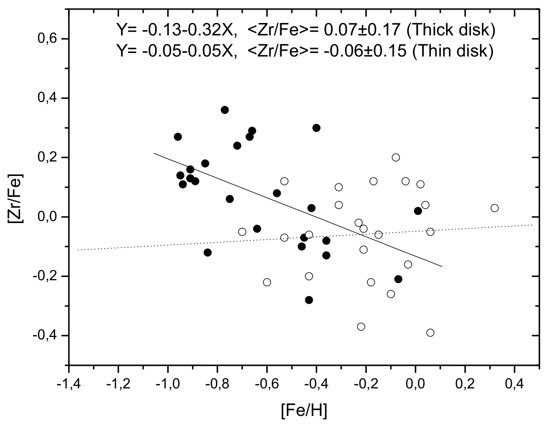

Figure 2: The run of [Zr/Fe] with [Fe/H].The notation is the same as in Fig.1.

II 4555 Å, which we used in our calculations, NLTE effects are small for [Fe/H] > -1.9. For Eu 6645 Å, the correction NLTE ranges from 0.04 dex to 0.06 dex. The dependences of n-capture elements abundances on metalliciti are presented in Fig. 1.

4. Results and conclusions

The dependences of [El/Fe] vs. [Fe/H] were presented on figures 1-8. Thick disk stars are marked as filled circles, and thin disk stars as open circles. Linear least-squares fits to both samples, the equations and mean values of Y, Zr, Ba, La, Ce, Nd, Sm and Eu abundances are given in the same place.

The abundance behavior of different elements for the two disks is different. The average Y, Zr, La, Nd, Sm

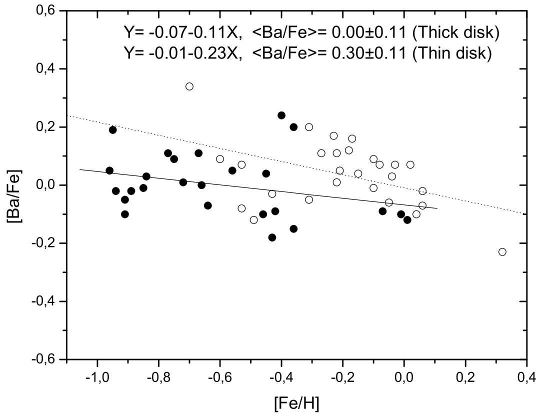

Figure 3: The run of [Ba/Fe] with [Fe/H].The notation is the same as in Fig.1.

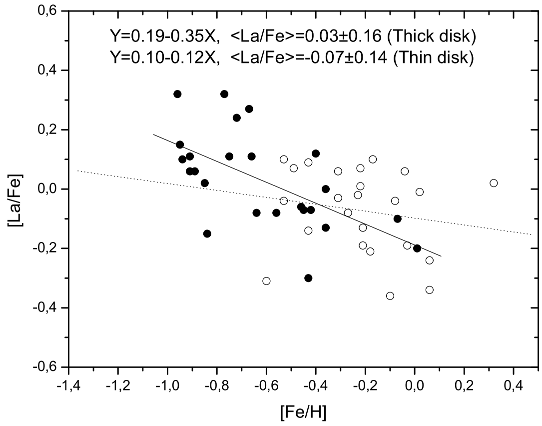

Figure 4: The run of [La/Fe] with [Fe/H]. Thick disk stars are marked as filled circles, and thin disk stars as open circles.

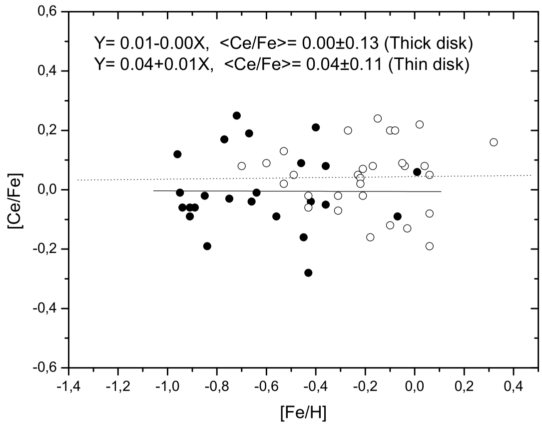

Figure 5: The run of [Ce/Fe] with [Fe/H].The notation is the same as in Fig.1.

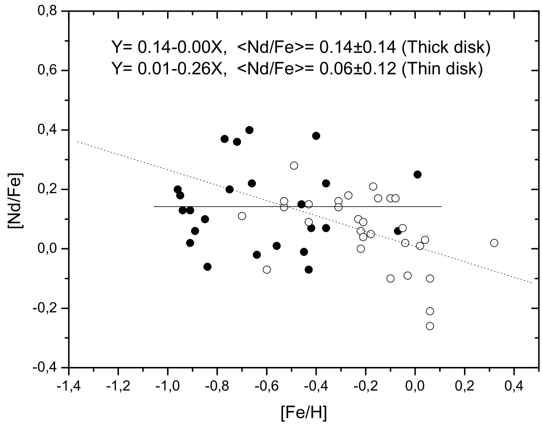

Figure 6: The run of [Nd/Fe] with [Fe/H].The notation is the same as in Fig.1.

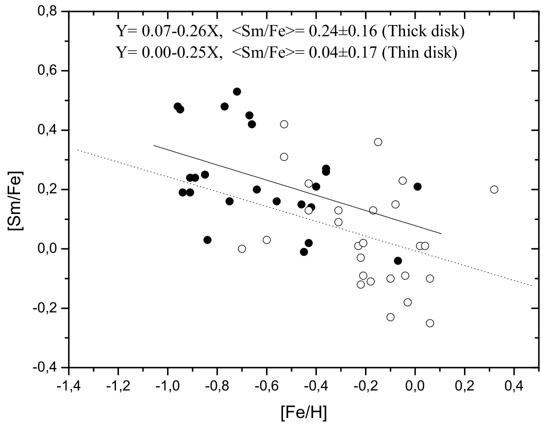

Figure 7: The run of [Sm/Fe] with [Fe/H].The notation is the same as in Fig.1.

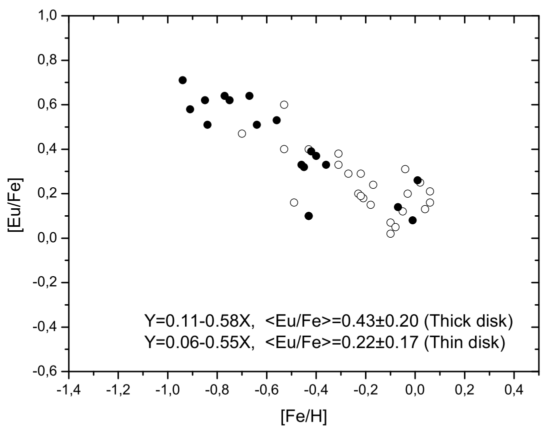

Figure 8: The run of [Eu/Fe] with [Fe/H].The notation is the same as in Fig.1.

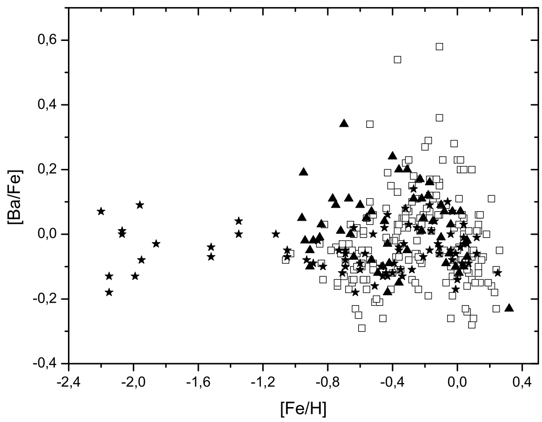

Figure 9: The run of [Ba/Fe] with [Fe/H].

and Eu abundances are higher in the thick disk stars than those of thin disk; the mean values of Ce abundance for two subsamples are similar within determination errors. The thin and thick disk stars clearly show similar abundance trends for Y, Ba, La, Ce, Sm, Eu. However, the Eu abundance shows remarkable declination, the La, Sm show some declination, the Nd shows one only for thin disk stars, and Zr shows one for thick disk stars. The Ce abundance do not show any declination. Break on metallicity close to -0,4 is observed for Ba, the increase of the Ba abundances for thin disk stars is observed.

We observe in our sample of stars the trend of [Ba/Fe] and [Eu/Fe] vs. [Fe/H] similar to the those for disk stars studied in the works Edvardsson (1993) and Mashonkina (2000) (see, Fig.9).

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