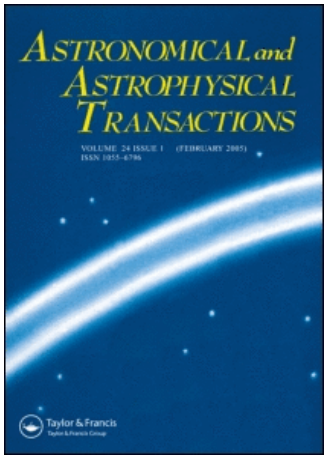

Astronomical & Astrophysical Transactions
The Journal of the Eurasian Astronomical Society
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713453505

Magnesium abundance in the Galactic thick-disc stars and subsystem formation history

V. A. Marsakov; T. V. Borkova

Online Publication Date: 01 April 2006
To cite this Article: Marsakov, V. A. and Borkova, T. V. (2006) 'Magnesium abundance in the Galactic thick-disc stars and subsystem formation history', Astronomical & Astrophysical Transactions, 25:2, 153 - 155
To link to this article: DOI: 10.1080/10556790600938560
URL: http://dx.doi.org/10.1080/10556790600938560

Astronomical and Astrophysical Transactions
Vol. 25, Nos. 2–3, April–June 2006, 153–155

Magnesium abundance in the Galactic thick-disc stars and subsystem formation history

V. A. MARSAKOV* and T. V. BORKOVA

194 Stachki Street, Rostov-on-Don 344090, Russia

(Received 2 August 2006)

The space velocities and Galactic orbital elements of stars calculated from the currently available high-accuracy observations in our compiled catalogue of spectroscopic magnesium abundances in dwarfs and subgiants in the solar neighbourhood are used to identify thick-disc objects. We analyse the relations between chemical, spatial and kinematic parameters of F–G stars in the identified subsystem.

Keywords: Galaxy (Milky Way); Stellar chemical composition; Thick disc; Galactic evolution

The relative magnesium abundances in thick-disc stars are shown to lie within the range $0.0\,\mathrm{dex} < [\mathrm{Mg/Fe}] < 0.5\,\mathrm{dex}$ and to decrease with increasing metallicity starting from $[\mathrm{Fe/H}] \approx -1.0\,\mathrm{dex}$ (figure 1). This is interpreted as evidence for the longer duration of the star formation process in the thick disc.

Vertical gradients in the metallicity ($\mathrm{grad}_Z\ [\mathrm{Fe/H}] = -0.13 \pm 0.04\,\mathrm{kpc}^{-1}$) and relative magnesium abundance ($\mathrm{grad}_Z\ [\mathrm{Mg/Fe}] = 0.06 \pm 0.02\,\mathrm{kpc}^{-1}$) are found, which can be present in the subsystem only in the case when its formation occurs in a slowly collapsing protogalaxy.

However, the gradients in the thick disc disappear if stars whose orbits lie in the Galactic plane but have high eccentricities and low azimuthal space velocities atypical of thin-disc stars are excluded from the sample. If these stars were not of the thick-disc type, then the model of the subsystem's formation through the interaction of the early Galaxy with its satellites becomes of current interest. The large spread in relative magnesium abundance ($-0.3\,\mathrm{dex} < [\mathrm{Mg/Fe}] < 0.5\,\mathrm{dex}$) in the stars of the metal-poor 'tail' of the thick disc, which constitute about 8% of the subsystem, can be explained in terms of their formation inside isolated interstellar clouds that interacted weakly with the matter of a single protogalactic cloud. We have found a statistically significant negative radial gradient in relative magnesium abundance in the thick disc ($\mathrm{grad}_R\ [\mathrm{Mg/Fe}] = -0.03 \pm 0.01\,\mathrm{kpc}^{-1}$) instead of the expected positive gradient (figure 2). The smaller perigalactic orbital radii and the higher eccentricities for stars richer in magnesium, which among other stars are currently located in a small volume

*Corresponding author. Email: marsakov@ip.rsu.ru

Astronomical and Astrophysical Transactions
ISSN 1055-6796 print/ISSN 1476-3540 online © 2006 Taylor & Francis
http://www.tandf.co.uk/journals
DOI: 10.1080/10556790600938560

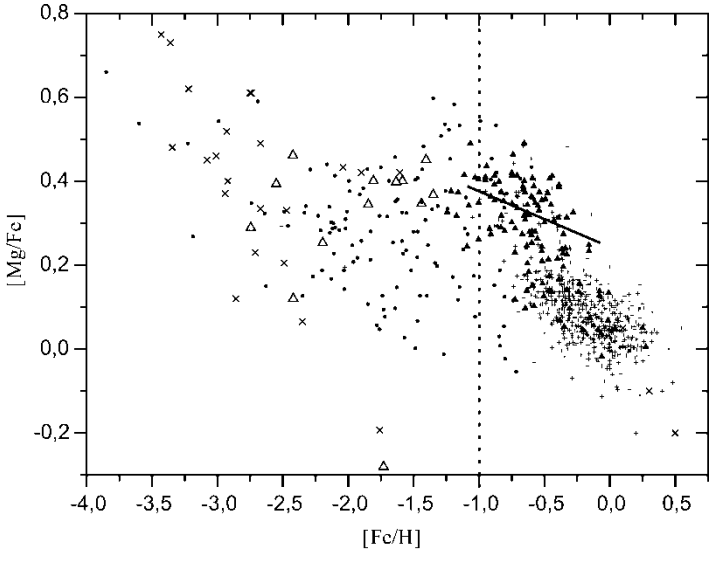

Figure 1. The metallicity versus the relative magnesium abundance for all the stars of our catalogue: full triangles, thick-disc stars; open triangles, stars of the metal-poor thick-disc tail; vertical dotted lines, the point at which the knee of the [Mg/Fe]–[Fe/H] relation begins; inclined straight lines, regression lines for metal-rich and simultaneously magnesium-rich thick-disc stars.

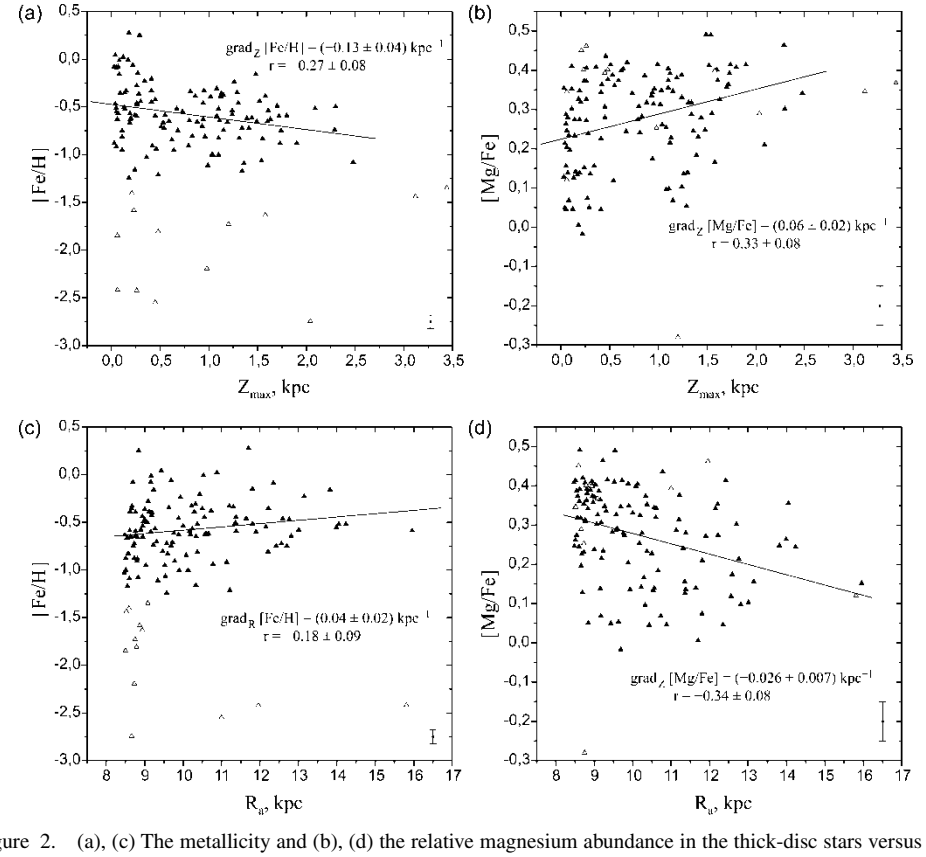

Figure 2. (a), (c) The metallicity and (b), (d) the relative magnesium abundance in the thick-disc stars versus (a), (b) their maximum distance from the Galactic plane and (c), (d) the apogalactic distance: solid lines, regression lines for the thick-disc stars. The gradients and correlation coefficients are shown.

of the Galactic space near the Sun, are assumed to be responsible for the gradient inversion. A similar but statistically less significant inversion is also observed in the subsystem for the radial metallicity gradient. Further studies and data on the abundances of other chemical elements in the subsystem's stars are required to refine the thick-disc formation time scale and model.

A full description of the investigation was published in [1].

Reference

[1] V.A. Marsakov and T.V. Borkova, Astron. Lett. **31** 515 (2005).