RATE OF ENRICHMENT OF THE GALACTIC DISC WITH METALS FROM DATA ON OPEN CLUSTERS

O.B. Dluzhnevaskaya, A.E. Piskunov, S.V. Vereshchagin
Astronomical Council, USSR Academy of Sciences

Recent investigations of stellar chemical composition made it possible to estimate some parameters of the galactic disc chemical evolution: the abundance gradient, d[Fe/H]/dR, and rate of enrichment, d[Fe/H]/dt. Practically all the conclusions of these investigations were based on data on chemical composition of single stars, for which the error in age determination is considerable.

In the present investigation an attempt was made to obtain the "metal abundance - age" relation on the basis of data on open clusters for which average values of both metallicity index and age are estimated with more accuracy than for single stars. We used determinations of chemical composition by Vasilevsky (1971), Jennens and Helfer (1975), Hirshfeld *et al.* (1978) - altogether for 37 clusters. The sample can be considered homogeneous as metallicity indices were determined by means of photometric calibration for red giant members of open clusters. Indices, [Fe/H], of all the clusters were corrected for abundance gradient in accordance with the results of Mayor (1976) by transforming to the same galactocentric distance. Cluster ages were mostly estimated by methods developed by Piskunov (1976) and based on using evolutionary tracks of stars with different masses and chemical compositions. The results are presented in Figure 1, where dots show positions of clusters with the corresponding values of [Fe/H] and age (the dashed line represents the least-squares solution, [Fe/H] = -3.2A - 0.14, where A is the age in units of 10^{11}y).

James E. Hesser (ed.), Star Clusters, 113–114.

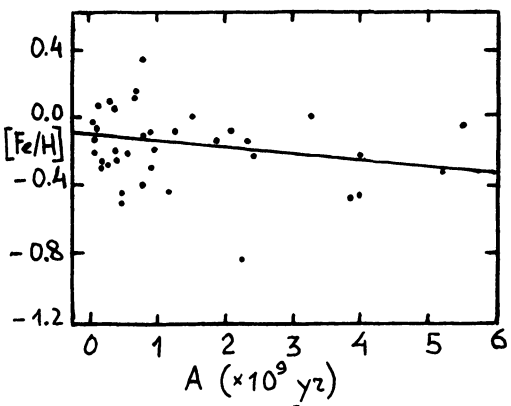

Figure 1. [Fe/H] vs age for 37 open clusters.

The population of the [Fe/H]-A diagram is nonuniform in age, which may result from incompleteness in the cluster sample and effects of dynamical decay of old clusters. The value of the $d[Fe/H]/dt = (3.2 \pm 2.5)/10^{11}$y agrees satisfactorily with the values 2.6 ± 1.3 obtained by Mayor (1976) and 3.0 ± 1.0 according to Perrin *et al.* (1978) for F and later dwarfs. It also agrees with the estimates obtained by Vereshchagin (1979) in the course of investigation of the catalog by Morel et al. (1976) by three independent methods (from "eccentricity-age" kinematic calibration, from spectral age calibration, and from comparison of metallicity distributions for B-A- and G2-K- dwarfs). Considerable metallicity disperson, especially among young clusters, should give impetus to calculations of galactic orbits for open clusters with the aim of localizing the formation area for clusters of different initial chemical composition.

REFERENCES

Hirshfeld, A., McClure, R.D., and Twarog, B.A.: 1976, in A.G.D. Philip and D.S. Hayes (eds.), IAU Symp. 80 "The HR-diagram", Reidel, Dordrecht, 163.

Jennens, P.A. and Helfer, H.L.: 1975, *Mon. Not. Roy Astron. Soc.* 172, 681.

Mayor, M.: 1976, *Astron. Astrophys. 48*, 301.

Morel, M., Bentolila, C., Cayrel de Strobel, G.,and Hauck, B.: 1976, in B. Hauck and P.C. Keenan (eds.), "Abundance Effects in Classification", IAU Symp. 72, Reidel, Dordrecht, p. 223.

Perrin, M.N., Hejlesen, P.M., Cayrel de Strobel, G., and Cayrel, R.: 1978, *Astron. Astrophys. 54*, 779.

Piskunov, A.E.: 1976, Nauchn. Inf. Astr. Council, *37*, 31.

Vasilevsky, A.E.: 1971, Ph.D. Thesis, Moscow.

Vereshchagin, S.V.: 1979, Nauchn. Inf. Astr. Council (in press).

https://doi.org/10.1017/S0074180900091701 Published online by Cambridge University Press