*Peculiar Versus Normal Phenomena in A-Type and Related Stars*
*ASP Conference Series, Vol. 44, 1993*
*M.M. Dworetsky, F. Castelli, and R. Faraggiana (eds.)*

# Li IN CLUSTERS : A and Am STARS

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ABSTRACT A and Am stars were observed in open clusters for their Li content. The Li abundance is therefore studied on the hot side of the Li gap along isochrones. It is discussed in relation to evolutionary model atmospheres including particle transport processes.

## INTRODUCTION

Observed photospheric abundances in 2-1.5 $M_\odot$ stars of known age are of interest to test envelope models that include particle transport processes with their interactions. Thus Li abundance observed in non-rotating stars (Am stars) can be compared to results drawn from model envelopes coupling diffusion and evolution (Richer 1992, Michaud 1992), and allows us to study the matter that lay deeper in the star during the preceding evolution. Observation of lithium in stars of different rotational velocities (A versus Am stars) gives constraints to any rotation-induced mixing, in particular it can test anew the existence of the "quiet zone" invoked by Vauclair (1991) and its role in controlling the transport of lithium.

To this aim, some forty A and Am stars were observed by us in open clusters or stellar groups with high spectral resolution and high signal-to-noise ratio at the CFH telescope. These clusters range in age from 0.8 to 8 $10^8$ yr. About ten stars are already observed in each cluster; it will be difficult to add other stars because there are limitations imposed by the weakness of the Li blend and/or the line width of A and Am stars rotating too fast.

This paper is a progress report dealing with some thirty stars observed by us or A. Boesgaard and co-workers.

## CLUSTER OBSERVATIONS

The preliminary abundance results for Li are presented as a function of temperature in Figs 1, 2, 3, and 4 with a scale where log N (H) = 12.0. The character Am, i.e., a weak calcium, is highlighted.

**Pleïades** Fig. 1 Age = 0.8 $10^8$ yr Distance = 133 pc
13 stars, half Am and half normal A, are observed. All possible candidate stars are observed.
The sequence of A and Am stars is not evolved and is at the beginning of the Main Sequence life evolution.

**Ursa Major** Fig. 2 Age = 5 $10^8$ yr Distance about 22 pc
5 stars are observed. Other stars could be observed.
The sequence of A and Am stars is advanced in the Main Sequence evolution.

For the 4 following clusters or group the sequence is well advanced in the Main Sequence evolution.

**Coma B.** Fig. 3 Age = 8 $10^8$ yr Distance = 89 pc
11 stars, Am in a great majority, are observed. All possible candidate stars are observed. In Fig. 3 the data is that found in Boesgaard 1987.

**Praesepe** Age = 8 $10^8$ y Distance = 174 pc
10 stars, all Am, are observed. Nearly all possible candidate stars are observed; no result is presented.

**Hyades** Fig. 4 Age = 8 $10^8$ yr Distance = 43.5 pc
11 stars, Am in a great majority, are observed. All possible candidate stars are observed and presented in Fig. 4.

**Hyades group** No figure. 3 stars, all Am, are observed. Other stars could be observed.

## COMMENTS

### Hyades stars and lithium on the blue side of the Li dip

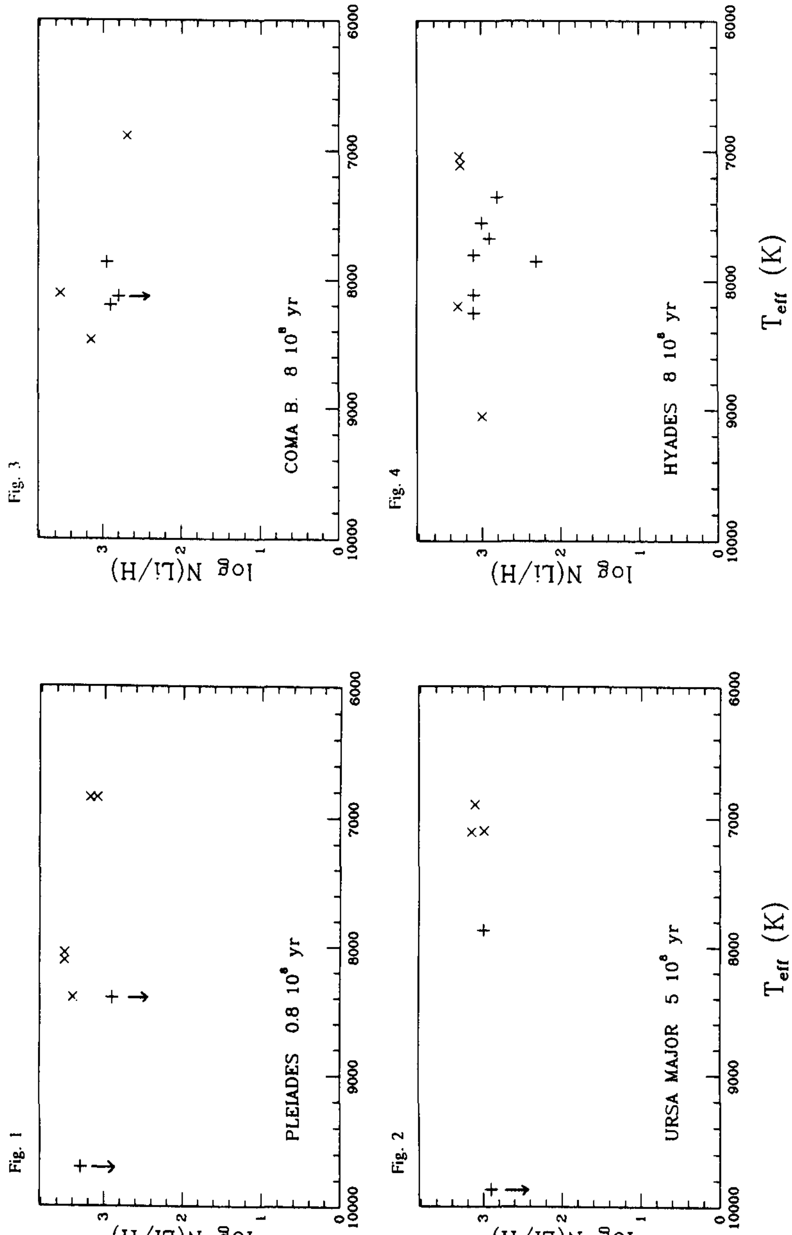
Confirming our results of 1989 (Burkhart & Coupry), if the two Li-deficient stars, 16 Ori and γ Cap, are excluded, the sharp-lined A and Am stars of the Hyades have the same normal Li abundance :

$$\overline{\log N(Li/H)} = 3.1 \qquad \sigma = 0.2 \qquad n = 10$$

Normal stars have a tendency to have higher abundances than Am stars.

In Fig. 5 the Li-temperature profile is shown in parallel with the Hyades Main Sequence, $M_V$ versus $T_{eff}$. For each star of the Hyades cluster or group with a good determination of its luminosity, the star position is shown in the Hyades Main Sequence. It clearly appears that one of the two Li-deficient stars, γ Cap, is not at the same stage of evolution as the others. Such complex behaviour is expected by Richer (1992) and Michaud (1992) in the case of Li which accumulates below the convection zone of Am stars.

We are waiting for the Hipparcos results: a better definition of the Hyades Main Sequence and an opportunity to add more Hyades group stars will improve this work.




Figs 1, 2, 3, and 4. The Li-temperature profile. × A stars (normal Ca) + Am stars (deficient Ca)

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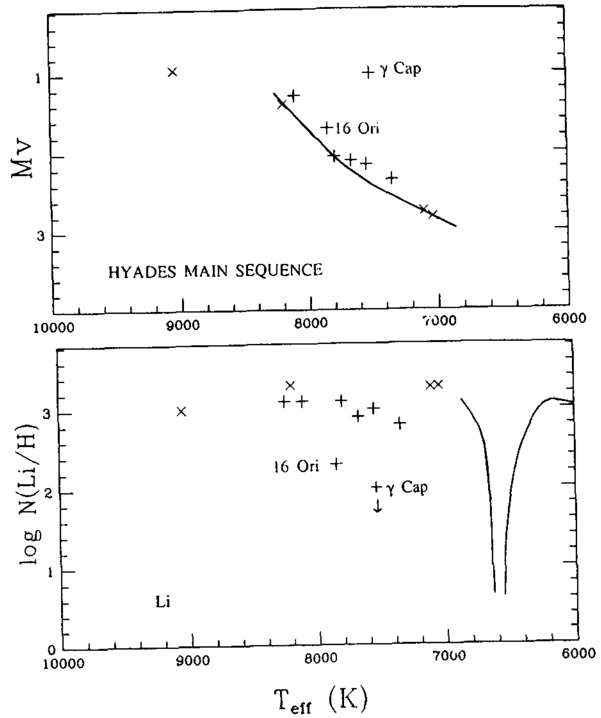


Fig. 5. The Li - temperature profile of the Hyades cluster and group compared to the Hyades Main Sequence adapted from Schwan 1991

× A stars (normal Ca) + Am stars (deficient Ca)

<u>Ca-normal A versus Ca-deficient Am stars</u>

In the 3 clusters, Pleïades, Coma B, and Hyades, the A stars are always higher than the Am stars in Figs 1, 3, and 4 around 8000 K. This different position clearly appears in Fig. 6 which is the combination of figures 1, 2, 3, and 4. In the range 8500-7200 K :

$\overline{\log N(Li/H)} = 3.4$ $\sigma = 0.15$ for 6 A stars

$\overline{\log N(Li/H)} = 2.9$ $\sigma = 0.2$ for 12 Am stars.

The difference of 0.5 dex between both means seems significant but must be ascertained using more results. If confirmed it would be very important to compare this fact to the computations of lithium depletion by rotation-induced mixing (Vauclair and co-workers).

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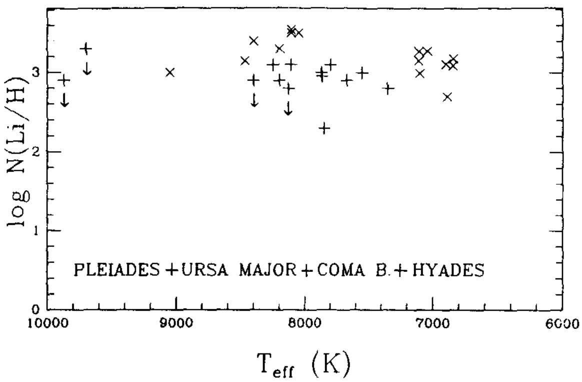


Fig. 6. Combination of Figs 1, 2, 3, and 4

× A stars (normal Ca) + Am stars (deficient Ca)

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