Search for associations containing young stars *

III. Ages and Li abundances

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ABSTRACT

Context. Our study is a follow-up of the SACY project, an extended high spectral resolution survey of more than two thousand optical counterparts of X-ray sources in the Southern Hemisphere targeted to search for young nearby associations. Nine associations have either been newly identified, or had their member list better defined. Groups belonging to the Sco-Cen-Oph complex are not considered in the present study.

Aims. These nine associations, with ages between about 6 Myr and 70 Myr, form an excellent sample to study the Li depletion in the pre-main sequence (PMS) evolution. In the present paper we investigate the use of Li abundances as an independent clock to constrain the PMS evolution.

Methods. Using our measurements of the equivalent widths of the Li resonance line and assuming fixed metallicities and microturbulence, we have calculated the LTE Li abundances for 376 members of different young associations. In addition we considered the effects of their projected stellar rotation.

Results. We present the Li depletion as function of age in the first hundred million years for the first time for the most extended sample of Li abundances in young stellar associations.

Conclusions. A clear Li depletion can be measured in the temperature range from 5000 K to 3500 K for the age span covered by the nine associations studied in this paper. The age sequence based on the Li-clock agrees well with the isochronal ages, ε Cha association being the only possible exception. The lithium depletion patterns for the associations presented here resemble those of the young open clusters with similar ages, strengthening the notion that the members proposed for these loose young associations have indeed a common physical origin. The observed scatter in the Li abundances hampers the use of Li to determine reliable ages for individual stars. For velocities above 20 km s⁻¹ rotation seems to play an important role inhibiting the Li depletion.

Key words. Stars: abundances – stars: pre-main sequence – stars: late-type – star: evolution

1. Introduction

In Torres et al. (2006) (hereafter Paper I) we report the results of a high-resolution optical spectroscopic survey aimed at searching for associations containing young stars (SACY) among optical counterparts of ROSAT All-Sky X-ray sources in the Southern Hemisphere. There we present the catalog resulting from the survey. We describe the convergence method developed to search for members of an association and a corresponding membership probability model. A membership to an association is defined by the hexa-dimensional space formed by the (UVW) velocity space and the (XYZ) spatial coordinates distribution. We take also into account the position in the HR diagram, eliminating very discrepant stars. Finally we check each member proposed confronting its Li content with the Li distribution of the association. The β Pictoris Association (βPA) is presented as an example of the method outlined in Paper I.

In paper I we also present the Li abundance analysis of the βPA, in order to confirm its youth. In contrast to open clusters where Li abundances have been studied over more than one decade (see Pallavicini et al., 2000), the results of Paper I was the first analysis of this kind for a young association.

Using the method described in Paper I, Torres et al. (2008) (hereafter Paper II) defined nine new young associations, namely, ε Chamaleontis (εChA), TW Hydrae (TWA), β Pictoris, Octants (OctA), Tucana-Horologium (THA), Columba (ColA), Carina (CarA), Argus (ArgA), and AB Doradus (ABDA). The present work continues along the same lines and aims at deriving the distribution of Li abundances for each of the nine associations resulting from a consolidated list of members. As these associations are young, covering ages from about 5 Myr up to that of the Pleiades, they form an interesting "laboratory" to study the Li depletion with age, as done for some open clusters Randich et al. (2001) Jeffries (2006).

2. Sample

In Table I we present some properties of the young associations studied in this paper derived in Paper II totaling 376 stars for which Li abundances were measured. Although the data are mainly from Paper I, a few additional data
Table 1. Number of members (N), number of Li eliminated stars ("intruders", n), average distance (in parsecs) and age (in Myr) of the considered associations

| Association     | N  | n   | distance | Age |
|-----------------|----|-----|----------|-----|
| ε Chamaeleontis (εChA) | 23 | 0   | 99 – 125 | 6   |
| TW Hydrae (TWA)   | 22 | 0   | 28 – 73  | 10  |
| β Pictoris (βPA)  | 48 | 2   | 10 – 80  | 9   |
| Octans (OctA)     | 15 | 0   | 82 – 175 | 20  |
| Tucana-Horologium (THA) | 45 | 1   | 37 – 78  | 30  |
| Columba (ColA)     | 44 | 0   | 35 – 150 | 30  |
| Carina (CarA)      | 23 | 1   | 45 – 160 | 30  |
| Argus (ArgA)       | 64 | 1   | 29 – 164 | 40  |
| AB Doradus (ABDA)  | 92 | 4   | 7 – 143  | 70  |

3. Li Abundance determinations

The observations were made using the FEROS spectrograph at the Coudé spectrograph of the Observatório do Pico dos Dias, LNA, Brazil (see Paper I for details). The Li abundances ($A_{\text{Li}}$) of the stars, in dex, in the system log(N(H)/N(He)) = 12, were determined using the programs of M. Spite, of the Paris-Meudon Observatory. Our method is similar to that used for the βPA in paper I. The main difference is that we now apply atmospheric models of Kurucz and Castelli (www.user.oat.ts.astro.it/castelli) instead of those of Gustafsson et al. (1975) used in paper I.

The $A_{\text{Li}}$ were determined from the resonance line at 6708 Å. The method consists in calculating the theoretical equivalent widths of the Li line ($EW_{\text{Li}}$) and comparing them with the corresponding observed ones. The $A_{\text{Li}}$ is changed until the difference between the calculated and the observed $EW_{\text{Li}}$ is smaller than 0.2 mÅ. The line was considered to be formed only by the $1^2\text{S}_1$ Li isotope. In the computation of the synthetic profile we take into account the four components of the $1^2\text{S}_1$ resonance line, being the wavelengths and the oscillator strengths given by Andersen et al. (1984). (Wavelengths: $\lambda$6707.754, $\lambda$6707.766, $\lambda$6707.904, $\lambda$6707.917; and log gf: $-0.430$, $-0.200$, $-0.733$, $-0.510$, respectively.)

Effective temperatures were obtained from the photometric and spectroscopic data available. The calibrations used were mainly those of Kenyon & Hartmann (1993) and Schmidt-Kaler (1982). Some additional information was included from Bessell (1979) and from Ducati et al. (2001). If a reliable Cousins (V-I)$_c$ color index was available, either from our observations, from Hipparcos or from other sources in the literature, this was used to derive $T_{\text{eff}}$. In the absence of (V-I)$_c$, we used the Johnson (B-V), mainly derived from TYCHO-2 but also obtained from various sources in the literature. We considered the (B-V) colors from TYCHO-2 reliable only for stars brighter than magnitude 10. Finally, if no reliable photometry was available, we used the spectral type to obtain the effective temperature.

The other model parameters were kept fixed: metallicity at [Fe/H] = 0.1 (see Castilho et al., 2005); gravity log $g$ was fixed at 4.5 for the dwarfs, and at 4.0 for the subgiants, according to the spectral classification of Paper I. The microturbulence velocity was fixed at 1.5 km s$^{-1}$ for all stars.

3.1. Error Analysis

In order to assess our internal errors we study the variations of the Li abundance as a function of model parameters and the equivalent width (Table 2). Our main error source is the effective temperature. The unknown parameters, [Fe/H] and the microturbulence velocity are less important, and the values used are good estimates. The small sensitivity of the Li abundance with the microturbulence velocity may be surprising, but it can be explained by the use of the fine structure of the Li line and by the fact that each line component is a weak line, thus not making very sensitive contribution to this parameter. An error of 10% for the EW is perhaps optimistic for the weak lines. An increase of the error of the EW to 20% results in a variation of $A_{\text{Li}}$ of 0.08 at $T_{\text{eff}}$ = 4000 K and of 0.09 at 6100 K. From Table 3 we can say that our internal errors are smaller than 0.2, sufficient to reach our goal. As can be seen from our abundance results in the figures, even a difference as high as 0.2 does not modify any of our conclusions.

How does the choice of different models change our results? In order to address this question, we compare our results using Kurucz models with those using the Uppsala group models, which were used in paper I. Using atmospheric models calculated with the MARCS code, developed by the Uppsala group (http://marcs.astro.uu.se/) (see Gustafsson et al., 1973), we get $A_{\text{Li}}$0.09 larger at 4000 K than using Kurucz models. At 6000 K the difference is 0.07, in the same direction. For homogeneity purposes, we used Kurucz models in our analysis because they begin at 3500 K whereas MARCS models begin only at 4000 K. Nevertheless, this shows how sensitive the use of different $A_{\text{Li}}$ from different authors can be. In this case the difference

obtained meanwhile are included and will be published in forthcoming papers.

These new observations allowed us to refine the definitions for some of the associations. For the ColA, we are able to obtain a similar but more consistent solution with a few changes in the member list with respect to those of Paper II (three stars are now rejected and six new ones are included).

For the ABDA, three new members have been proposed, one of them, HD 82879, previously proposed to the εChA. HD 53842, proposed by Zuckerman & Song (2004) as a member of the THA, was previously rejected in Paper II due to a compilation error. Its re-introduction now as a member proposed for the THA has no other consequences for the mean values of this association.

As explained in Paper II, IC 2391 members were incorporated in the ArgA member list. Similarly members of the open cluster η Cha have been put together with the εChA members forming an unique group. The link between young loose associations and some open clusters is going to be discussed in forthcoming papers.
Table 2. Variation of Li abundance as a function of EW and model parameters. $\Delta A(Li)_1$ is the variation at 4000 K and $\Delta A(Li)_2$ at 6100 K.

| Parameter | change | $\Delta A(Li)_1$ | $\Delta A(Li)_2$ |
|-----------|--------|-----------------|-----------------|
| $T_{\text{eff}}[K]$ | ±100 | ±0.19 | ±0.05 |
| log $g$ | ±0.5 | ±0.16 | ±0.12 |
| microturbulence [km s$^{-1}$] | ±0.5 | ±0.05 | ±0.02 |
| EW | ±10% | ±0.05 | ±0.02 |
| $[Fe/H]$ | ±0.1 | ±0.04 | ±0.02 |

![Figure 1. Comparison between our results and those of Randich et al. (2001) for the stars in IC2391 and IC2602.](image)

between our $A_{\text{Li}}$ results and those of other authors could even be larger than 0.2, which we adopt as internal error.

As an additional test, we compared our abundances for the IC 2391 (considered as ArgA members) with those from Randich et al. (2001). In addition using the EW from these authors, we also computed the Li abundances for the IC2602 members as described above. The agreement between both Li abundances is very good (Figure 1) validating our method.

4. Results and discussion

Table 1 summarizes some properties given in Paper II for the nine young associations. This table contains the proposed ages, the most important parameter for our Li evolution study. Distance is a rather meaningless quantity for these nearby associations (due to their proximity their members have a wide range of distances). The Li abundances determined for all high probability members, in all 376 stars, are given in Tables 4 to 12. The tables contain the identifications of the members of each association, their coordinates, the EW Li, the $T_{\text{eff}}$, the $A_{\text{Li}}$ and the projected stellar rotational velocities ($v \sin i$). More details about the association memberships can be found in Paper II.

Stars cooler than 3500 K are not covered by the Kurucz models and are given here for reference only. Those values are calculated with extrapolated models, and they have errors potentially larger than those considered below. Those objects have not been considered in our figures and discussion.

4.1. Lithium Depletion Pattern and open cluster ages

The Lithium Depletion Pattern (LDP) for all nine young associations studied in this paper is shown in Figure 2. For each association stars were divided into two groups according to their $v \sin i$). Stars rotating slower than 20 km s$^{-1}$ are shown as open squares, whereas those rotating faster than 20 km s$^{-1}$ are marked as filled circles. Stars whose $v \sin i$ could not be determined are plotted as crosses. Along with the derived abundances and effective temperatures, a 4th-degree polynomial fit of the data is shown as a solid line. This line defines the LDP for each association.

Using the data from Sestito & Randich (2003), we computed the LDPs for the young clusters studied by these authors and compared with those LDPs of the young associations at similar ages.

In the top panel of Figure 4, we show the Li abundances for IC 2391 and IC 2602 which have an age similar to that of THA (30 Myr). The LDP of THA is shown as a thick black line whereas the obtained LDP for these two young clusters are seen as a thick dashed black line. For comparison, the LDP for βPA (10 Myr) and ABDA (70 Myr) are shown as light solid and dashed light line, respectively.

In the middle panel of Figure 4, the Li abundance for α Per and NGC 2451 (50 Myr) are plotted. In this case, the LDP shown as thick solid line is that of ArgA. Solid and dashes light lines are again the LDPs for βPA and ABDA. Finally, the Li abundances for the Pleiades members are shown in the bottom panel of Fig. 4. The thick black line is the LDP of ABDA. The βPA LDP is shown as solid light line along with the LDP of THA shown as light dashed line.

Dispite of the dispersion in the observational data, the agreement between the LDPs of the young clusters and those of the young association is reasonably good. The exception is the data for α Per and NGC 2451 which show a level of depletion close to that of the Pleiades. According to the LDP of the ArgA, abundances ~0.5 dex higher were expected.

Although the comparison with the young clusters remains marginal (low number of clusters and high dispersion), the good agreement found is already an important result. First, it brings confidence in our derivation of the Li abundances described in Sec. 3. Secondly, the fact that the LDP of the nine associations are similar to the LDP of open clusters of similar ages strengthens the notion that the associations presented in Paper II are indeed physical groups of stars sharing a common formation history.

4.2. Lithium Depletion Pattern and the relative ages

All observational LDPs (i.e, the polynomial fits to the observed Li abundances as a function of $T_{\text{eff}}$ shown in Figure 2) have been plotted together in the left panel of Figure 3. LDPs for each association are identified by its line style and marker type (see caption of Figure 3). As expected, Li abundances for stars with temperatures hotter than about 5000 K are almost constant over
groups are indistinguishable indicating that indeed they are complex. From the Li abundance point of view, these three structures of the Great Austral Young Association (GAYA) CarA and ColA have been suggested in Paper II as being potentially a bit older. This is discussed below in Sec. 4.3.

The fact that a Li depletion is seen might indicate that (e.g. Palla et al., 2005; Zapatero Osorio et al., 2002). The T-Tauri stars (Martin et al., 1994, e.g.) and young clusters (Martin & Montes, 1997, 2001; Stauffer et al., 1989; Martin & Montes, 1997; Randich et al., 1998; Martín, 1997). On the other hand, for the T associations studied here. The only exception being the cChA which seems to be older according to its LDP. Given the isochronal age of 6 Myr derived in Paper II, one would expect a flat LDP around the cosmic Li abundance of $A(\text{Li}) = 3.1$ as found in the T-Tauri stars (Martin et al., 1994, e.g.) and young clusters (e.g. Palla et al., 2003; Zapatero Osorio et al., 2002). The fact that a Li depletion is seen might indicate that cChA could be a bit older. This is discussed below in Sec. 4.3.

The three associations with 30 Myrs, namely, THA, CarA and ColA have been suggested in Paper II as being structures of the Great Austral Young Association (GAYA) complex. From the Li abundance point of view, these three groups are indistinguishable indicating that indeed they have very similar ages in agreement with the suggestion of Paper II.

From Figure 2 it is clear that there is an important scatter around the mean LDP for any given associations. This scatter is real and not a consequence of the errors. For example, the stars HD 6569, HIP 26401B and UY Pic, all members of the ABDA (that is, with the same age and metallicity) have all high-quality observations, similar $T_{\text{eff}}$ values (therefore similar masses) and $v \sin i$ (10, 5 and 9 km s$^{-1}$). However, they show very different $A_{\text{Li}}$ values, respectively 2.28, 3.32 and 3.66.

The bottom line is that a distinct Li depletion history causes an important scatter in the observed LDP preventing the use of Li as a clock to date individual stars. However, statistically speaking, Li abundances derived in a homogeneous way as done in this paper can be used to determine relative ages of the young associations provided that the associations possess enough members cooler than 5000-4500 K. Our conclusions are similar to those of Mentuch et al. (2008) who also found a qualitatively good agreement between the Li abundances and the isochronal ages of a small number of stars belonging to five associations studied here.

As for the Li "intruders", only two stars (HD 190102 in the $\beta$PA and CD-41 2076 in the ABDA) out of the nine rejected as members of the associations proposed in Paper II based on their low Li abundance have $A(\text{Li})$ values relatively close to the LDP of their associations. They are
shown as filled hexagons in Figure 2. The other are shown only in Tables 4-12. HD 190102 was rejected due to the fact that its Li is too low even if the typical scatter in the Li abundance of the βPA members is considered. CD-41 2076 which has a Li still acceptable for the ABDA lies 1.1 mag above its isochrone. In order to either of these two objects to be reconciled as a bonafide member, their photometric magnitudes (from TYCHO-2) must have a large error and/or they must be an unresolved binary. In this last case probably the Li abundance could have been underestimated. We found no indication suggesting the presence of a companion around these two objects. In any case, these two examples show that we must act with caution when eliminating stars based only on Li abundances.

4.3. The age of the ϵ Cha Association

The age estimated in PaperII for the ϵ Cha A is 6 Myr which is within the range of 3-15 Myr found in the literature (FERNÁNDEZ et al. 2008, TERRANERA et al. 1999, JILINSKI et al. 2005, FEIGELSON et al. 2004). We should bear in mind that a given association might have a different member list according to the method and criteria used to define it. Therefore, ages determined by different methods are not always trivial to be compared.

The Li abundances for NGC 2264 (5 Myr) show a flat distribution around A(Li) ~ 3.2 for stars with 6500 K > Teff > 4000 K suggesting that no Li depletion has taken place (SESTITO & RANDICH 2007, KING 1998). Palla et al. (2005) see no depletion either for the bulk of Orion Nebular Cluster (ONC) (3 Myr) stars. The mean abundance is again 3.1-3.3. Undepleted Lithium abundances were also reported by ZAPATERO OSORIO et al. (2002) for the young σ Ori cluster. Based on theoretical predictions for the Li depletion, Zapatero Osorio et al. estimated the age of σ Ori to be around 2-4 Myr. It is worth noticing that for the ONC and the σ Ori cluster a small group of stars was found to show a considerable Li depletion with respect to the inter-
stellar abundance. The observed depletion in the Li content was explained by Palla et al. (2005) for the ONC and by Sacco et al. (2007) for σ Ori as a result of an age spread within those two clusters.

Our Figure 3 indeed supports the idea that the age of the cChaA is at least as young as the TWA but older than that of NGC 2264, ONC and, the σ Ori cluster and certainly younger than the βPA.

4.4. Li and rotation

A careful inspection of Figure 2 shows that stars rotating faster than 20 km s$^{-1}$ (filled circles) are often above the polynomial fit of the LDP of the associations suggesting that already at this level, rotation might play a role in the Li depletion.

This is better seen in Figure 7 where the histograms of the differences between the derived abundances and the polynomial fit of the observed LDP is shown for starts rotating slower and faster than 20 km s$^{-1}$.

Addressing the role of rotation using $V \sin i$ might lead to erroneous conclusions since the actual rotation of the star is not known due to the sin $i$ factor. As an example, we compare in Figure 8 the spectral region around the Li 6708 line for HD 6569 ($v \sin i = 10$ km s$^{-1}$) and HIP 26401B ($v \sin i = 5$ km s$^{-1}$). The Ca I line at λ6718, a good indicator of temperature (see Cutispoto et al., 1999), is also shown in the figure. The similitude of their Ca I lines confirms that both stars have very similar $T_{\text{eff}}$, despite the obvious distinct Li line intensities.

We have used the rotation-chromospheric flux relation derived by Noyes et al. (1984) using the Ca H & K lines ($R'_{\text{HK}}$) to estimate the rotation period for both stars. The $R'_{\text{HK}}$ were derived as described in Melo et al. (2006). The spectral region around the Ca H & K lines for both stars is shown in Figure 5. The calibration of Melo et al. (2006) yields a $R'_{\text{HK}}$ of $-4.336$ and $-4.190$ which translates into a rotation period of 7.2 days and 2.7 days for HD 6569 and HIP 26401B, respectively. According to the $R'_{\text{HK}}-P_{\text{rot}}$ calibration, HD 6569 is actually rotating almost 3 times slower than HIP 26401B.

Statistically speaking however, Figure 7 is worth of mentioning since the true distribution of equatorial velocities computed from a deconvolution process does not differ considerably from the projected one (e.g. Royer et al., 2007).

There is a vast literature showing that Li depletion is not only driven by convection, and that extra-mixing processes (or processes) able to inhibit Li depletion during the PMS) are at work (e.g. Bouvier, 2008; Deliyannis et al., 2000). The discussion of this complex issue is beyond the scope of this paper. Nevertheless, we point out that Figure 7 indicates that a deeper look into the Li-rotation connection in this sample could be worthwhile.

5. Conclusions

This is a systematic study of the evolution of the Li abundances for the most extended sample of pre-main sequence stars belonging to young, loose, nearby associations. Nine associations with a total of 376 stars have been considered covering ages from ~5 Myr to almost that of the age of the Pleiades. Our results were compared to Li studies in young open clusters.

Our main conclusions are the following:

- A clear Li depletion, considered as a measure of a systematic decrease of the Li abundance with age, can be measured in the temperature range from 5000 K to 3500 K for the age span covered by the nine associations studied in this paper.
- The age sequence based on the Li-clock agrees well with the isochronal ages of Paper II.
The rChA being the only possible exception with a LDP showing a considerable Li depletion for the late type stars in comparison to young cluster of similar age.

- A real scatter of the Li abundance values, with variations larger than those originating by internal or systematic errors, is present. This scatter hampers the use of Li to determine reliable ages for individual stars.

- The Li depletion patterns for the associations presented here resemble those of young open clusters with similar ages, strengthening the notion that the stars of these loose associations have indeed a common physical origin.

- For velocities above 20 km s\(^{-1}\) rotation seems to play an important role inhibiting the Li depletion.

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Fig. 5. Regions used to compute the CaII H & K flux. HD 6569 and HIP 26401B are shown in the top and bottom panels, respectively.

Fig. 6. Superposition of the spectra of the stars HD 6569 and HIP 26401B in the Li region. Both stars belong to the AB Doradus association and have the same T\(_\text{eff}\) - note the similarity between the CaI lines, a good temperature indicator - but have distinct Li line intensities.

Fig. 7. Histogram of the differences between the derived abundances and the polynomial fit of the observed LDP. Dark gray and hatched light gray bins represent stars rotating slower and faster than 20 km s\(^{-1}\), respectively.
\begin{table}
\begin{center}
\caption{The $\beta$ Pictoris Association}
\begin{tabular}{lcccccc}
\hline
Ident & $\alpha$(2000) & $\delta$(2000) & EW$_{\text{Li}}$ & T$_{\text{eff}}$ & A$_{\text{Li}}$ & $v\sin(i)$ \\
 & (2000) & & m\AA & K & & km s$^{-1}$ \\
\hline
HIP 10679 & 02 17 24.7 & +28 44 30 & 160 & 5988 & 3.08 & 8 \\
HD 14062 & 02 17 25.3 & +28 44 42 & 140 & 6368 & 3.29 & 45 \\
BD+30 397B & 02 27 28.1 & +30 58 41 & 110 & 3544 & -0.19 & 1 \\
AG Tri & 02 27 29.3 & +30 58 25 & 220 & 4351 & 1.55 & 5 \\
BD+05 378 & 02 41 25.9 & +05 59 18 & 450 & 4100 & 1.51 & 9 \\
HIP 23418 & 05 01 58.8 & +09 55 59 & 0 & 3496 & & 8 \\
BD-21 1074BC & 05 06 49.5 & -21 35 04 & 20 & 3496 & -1.07 & 6 \\
V343 Nor & 05 32 04.5 & -03 05 29 & 100 & 3566 & -0.20 & 12 \\
\beta Pic & 05 47 17.1 & -51 03 59 & 0 & 8543 & & 139 \\
AO Men & 06 18 28.2 & -51 03 59 & 420 & 4377 & 1.91 & 16 \\
HD 139084B & 15 38 56.8 & -57 42 19 & 460 & 3314 & 0.18 & 16 \\
V343 Nor & 15 38 57.5 & -57 42 27 & 292 & 5168 & 2.65 & 17 \\
V824 Ara & 17 17 25.5 & -66 57 04 & 250 & 5383 & 2.73 & 31 \\
BD-21 1074A & 17 17 31.3 & -66 57 06 & 20 & 3413 & -1.17 & 6 \\
GSC 8350-1924 & 17 29 20.7 & -50 14 53 & 50 & 3480 & -0.66 & 3 \\
CD-54 7336 & 17 29 55.1 & -54 15 49 & 360 & 5036 & 2.63 & 35 \\
HD 161460 & 17 48 33.7 & -53 06 43 & 320 & 5140 & 2.62 & 10 \\
HD 164249 & 18 03 03.4 & -51 38 56 & 107 & 6597 & 3.31 & 22 \\
HD 164249B & 18 03 04.1 & -51 38 56 & 70 & 3607 & -0.30 & 10 \\
HD 161589 & 18 06 49.9 & -43 25 31 & 0 & 7829 & & 104 \\
V4046 Sgr & 18 14 10.5 & -32 47 33 & 440 & 4361 & 1.92 & 14 \\
GSC 7396-0759 & 18 14 22.1 & -32 46 10 & 190 & 3619 & 0.18 & 3 \\
HD 168210 & 18 19 52.2 & -29 16 33 & 290 & 5645 & 3.10 & 115 \\
HD 172555 & 18 45 26.9 & -64 52 17 & 0 & 8323 & & 116 \\
CD-64 1208 & 18 45 36.9 & -64 51 48 & 490 & 4148 & 1.65 & 110 \\
TYC 9073-0762-1 & 18 46 52.6 & -62 10 36 & 332 & 3649 & 0.49 & 10 \\
CD-31 16041 & 18 50 44.5 & -31 47 47 & 492 & 3889 & 1.17 & 50 \\
PZ Tel & 18 53 05.9 & -50 10 50 & 287 & 5344 & 2.77 & 69 \\
TYC 6872-1011-1 & 18 58 04.2 & -29 53 05 & 483 & 3850 & 1.08 & 34 \\
CD-26 13904 & 19 11 44.7 & -26 04 09 & 320 & 4655 & 2.13 & 10 \\
\eta Tel & 19 22 51.2 & -54 25 26 & 0 & 9670 & & 330 \\
HD 181327 & 19 22 58.9 & -54 32 17 & 120 & 6597 & 3.36 & 21 \\
HD 191089 & 20 09 05.2 & -26 13 26 & 95 & 6521 & 3.21 & 45 \\
AT MicB & 20 41 51.1 & -32 26 10 & 0 & 3331 & & 16 \\
AT MicA & 20 41 51.2 & -32 26 07 & 0 & 3341 & & 10 \\
AU Mic & 20 45 09.5 & -31 20 27 & 80 & 3649 & -0.16 & 9 \\
HD 199143 & 20 55 47.7 & -17 06 51 & 147 & 6330 & 3.29 & 129 \\
AZ Cap & 20 56 02.7 & -17 10 54 & 420 & 4197 & 1.64 & 16 \\
CP-72 2713 & 22 42 45.9 & -71 42 21 & 440 & 3921 & 1.17 & 8 \\
WW PsA & 22 44 58.0 & -33 15 02 & 0 & 3391 & & 12 \\
TX PsA & 22 45 00.0 & -33 15 26 & 450 & 3316 & -0.09 & 17 \\
BD-13 6424 & 23 32 30.9 & -12 15 52 & 185 & 3715 & 0.35 & 9 \\
\hline
Intruders & & & & & & \\
HD 190102 & 20 04 18.1 & -26 19 46 & 110 & 5874 & 2.82 & 2 \\
TYC 9114-1267-1 & 21 21 28.7 & -66 55 06 & 15 & 3889 & -0.47 & 4 \\
\hline
\end{tabular}
\end{center}
\end{table}
Table 4. The Tucana-Horologium Association

| Ident    | α(2000) | δ(2000) | EW$_{Li}$ | T$_{eff}$ | A$_{Li}$ | $\nu$ sin(i) |
|----------|---------|---------|----------|-----------|---------|--------------|
|          | mÅ      | K       | km s$^{-1}$ |
| HD 105   | 00 05 52.5 | -41 45 11 | 183 | 6178 | 3.20 | 14           |
| HD 987   | 00 13 53.0 | -74 41 18 | 202 | 5481 | 2.77 | 7            |
| HD 1466  | 00 18 26.1 | -63 28 39 | 130 | 6368 | 3.26 | 18           |
| HIP 1910 | 00 24 09.0 | -62 11 04 | 194 | 3860 | 0.65 | 21           |
| CT Tuc   | 00 25 14.7 | -61 30 48 | 40  | 3841 | -0.13 | 7            |
| HD 2884  | 00 31 32.7 | -62 57 30 | 0  | 9670 |        | 107          |
| HD 2885  | 00 31 33.5 | -62 57 56 | 18  | 9036 | 3.90 | 6            |
| HD 3003  | 00 32 43.9 | -63 01 53 | 0  | 9146 |        | 78           |
| HD 3221  | 00 34 51.2 | -61 54 58 | 360 | 4309 | 1.73 | 123          |
| CD-78 24 | 00 42 20.3 | -77 47 40 | 291 | 4540 | 1.94 | 19           |
| HD 8558  | 01 23 21.3 | -57 28 51 | 196 | 5683 | 2.94 | 14           |
| CC Phe   | 01 28 08.7 | -52 38 19 | 168 | 4894 | 2.09 | 3            |
| DK Cet   | 01 57 49.0 | -21 54 05 | 190 | 5950 | 3.14 | 15           |
| HD 13183 | 02 07 18.1 | -53 11 56 | 229 | 5721 | 3.05 | 24           |
| HD 13246 | 02 07 26.1 | -59 40 46 | 141 | 6368 | 3.30 | 36           |
| CD-60 416| 02 07 32.2 | -59 40 21 | 254 | 4268 | 1.50 | 11           |
| φ Eri    | 02 16 30.6 | -51 30 44 | 0  | 15665 |        | 240          |
| ε Hyi    | 02 39 35.4 | -68 16 01 | 0  | 10852 |        | 96           |
| CD-53 544| 02 41 46.8 | -52 59 52 | 298 | 4087 | 1.27 | 80           |
| AF Hor   | 02 41 47.3 | -52 59 31 | 10  | 3511 | -1.35 | 10           |
| CD-58 553| 02 42 33.0 | -57 39 37 | 120 | 4216 | 1.07 | 6            |
| CD-35 1167| 03 19 08.7 | -35 07 00 | 65  | 4100 | 0.59 | 6            |
| CD-46 1064| 03 30 49.1 | -45 55 57 | 229 | 4487 | 1.75 |            |
| CD-44 1173| 03 31 55.7 | -43 59 14 | 251 | 4110 | 1.23 | 11           |
| HD 22213 | 03 34 16.4 | -12 04 07 | 260 | 5729 | 3.12 | 42           |
| HD 22705 | 03 36 53.4 | -49 57 29 | 154 | 6254 | 3.26 | 18           |
| BD-12 943| 04 36 47.1 | -12 09 21 | 240 | 5460 | 2.84 | 17           |
| HD 29615 | 04 38 43.9 | -27 02 02 | 200 | 6026 | 3.22 | 18           |
| HD 30051 | 04 43 17.2 | -23 37 42 | 120 | 6798 | 3.44 |            |
| TYC 5083-0455-1| 04 48 00.7 | -50 41 26 | 40  | 3908 | 0.01 | 5            |
| HD 32195 | 04 48 05.2 | -80 46 45 | 130 | 6368 | 3.26 | 41           |
| BD-20 951| 04 52 49.5 | -19 55 02 | 190 | 5083 | 2.35 |            |
| BD-19 1062| 04 59 32.0 | -19 17 42 | 230 | 4735 | 2.06 | 12           |
| BD-09 1108| 05 15 36.5 | -09 30 51 | 245 | 5683 | 3.05 | 18           |
| CD-30 2310| 05 18 29.0 | -30 01 32 | 310 | 4158 | 1.42 | 7            |
| HD 53842 | 06 46 13.5 | -83 59 30 | 6597 |        |      |              |
| α Pav    | 02 35 38.9 | -56 44 06 | 0  | 17726 |        | 35           |
| HD 202917| 21 20 50.0 | -53 02 03 | 227 | 5567 | 2.91 | 15           |
| HIP 107345| 21 44 30.1 | -60 58 39 | 55  | 3824 | -0.01 | 8            |
| HD 207575| 21 52 09.7 | -62 03 09 | 110 | 6483 | 3.25 | 30           |
| HD 207964| 21 55 11.4 | -61 53 12 | 100 | 7006 | 3.48 | 110          |
| TYC 9344-0293-1| 23 26 10.7 | -73 23 50 | 123 | 3816 | 0.36 | 61           |
| CD-86 147| 23 27 49.4 | -86 13 19 | 276 | 5481 | 2.88 | 74           |
| HD 22259B| 23 39 39.3 | -69 11 40 | 232 | 4629 | 1.94 | 15           |
| DS Tuc   | 23 39 39.5 | -69 11 45 | 216 | 5683 | 2.98 | 18           |

Intruders

|           |         |         |           |         |         |         |
| CD-34 521| 01 22 04.4 | -33 37 04 | 0  | 4226 |        | 5            |
| Ident     | α(2000) | δ(2000) | EW_{Li} | T_{eff} | A_{Li} | v_{sin(i)} |
|-----------|---------|---------|---------|---------|--------|------------|
| BD-16 331 | 02 01 35.6 | -16 10 01 | 190 | 6083 | 2.36 | 9 |
| BD-11 648 | 03 21 49.7 | -10 52 18 | 320 | 5225 | 2.77 | 27 |
| V1221 Tau | 03 28 15.0 | +04 09 48 | 275 | 5645 | 3.08 | 96 |
| HD 21955  | 03 31 20.8 | -30 30 59 | 230 | 5835 | 3.10 | 22 |
| HD 21997  | 03 31 53.6 | -25 36 51 | 0 | 8707 | 70 |
| BD-04 700 | 03 57 37.2 | -04 16 16 | 250 | 5506 | 2.91 | 14 |
| BD-15 705 | 04 02 16.5 | -15 21 30 | 220 | 4735 | 2.04 | 7 |
| HD 26980  | 04 14 22.6 | -38 19 02 | 183 | 6140 | 3.27 | 14 |
| HD 27679  | 04 21 10.3 | -24 32 21 | 180 | 5928 | 3.10 |
| CD-43 1395| 04 21 48.7 | -43 17 33 | 270 | 5683 | 3.10 | 26 |
| CD-36 1785| 04 34 50.8 | -35 47 21 | 300 | 4941 | 2.43 | 9 |
| BD+08 742 | 04 42 32.1 | +09 06 01 | 240 | 5225 | 2.62 | 14 |
| HD 30447  | 04 46 49.5 | -26 18 09 | 6897 | 70 |
| GSC 8077-1788 | 04 53 03.0 | -46 47 31 | 30 | 3655 | 0.62 |
| HD 31242  | 04 51 53.5 | -46 47 13 | 250 | 5721 | 3.09 |
| HD 272836 | 04 53 05.2 | -48 44 39 | 250 | 4917 | 2.31 |
| TYC 5900-1180-1 | 04 58 35.8 | -15 37 31 | 290 | 5383 | 2.87 | 40 |
| BD-08 995 | 04 58 48.6 | -08 43 40 | 270 | 5225 | 2.68 | 7 |
| HD 32372  | 05 05 10.1 | -41 01 07 | 210 | 5721 | 3.01 | 8 |
| AS Col    | 05 11 43.6 | -39 45 18 | 140 | 6483 | 3.37 | 72 |
| BD-08 1115| 05 24 37.3 | -08 42 02 | 280 | 5432 | 2.90 | 33 |
| HD 35841  | 05 26 36.6 | -22 29 24 | 6556 |
| HD 274561 | 05 28 55.1 | -45 34 58 | 270 | 4781 | 2.20 | 7 |
| HD 36329  | 05 29 24.1 | -34 30 56 | 220 | 5912 | 3.19 | 8 |
| AG Lep    | 05 30 19.1 | -19 16 32 | 230 | 5683 | 3.02 | 21 |
| HD 37484  | 05 37 39.6 | -28 37 35 | 125 | 6848 | 3.53 | 43 |
| TYC 0119-1242-1 | 05 37 45.3 | +02 30 57 | 330 | 4361 | 1.76 |
| TYC 0119-0497-1 | 05 37 46.5 | +02 31 26 | 300 | 4361 | 1.72 | 13 |
| BD-08 1195| 05 38 35.0 | -08 56 40 | 290 | 5352 | 2.84 | 29 |
| HD 38207  | 05 43 21.0 | -20 11 21 | 6656 |
| HD 38206  | 05 43 21.7 | -18 33 27 | 0 | 9366 | 41 |
| CD-38 2198| 05 45 16.3 | -38 36 49 | 250 | 5481 | 2.88 | 22 |
| CD-29 2531| 05 50 21.4 | -29 15 21 | 270 | 5225 | 2.68 |
| CD-52 1363| 05 51 01.2 | -52 38 13 | 290 | 5225 | 2.66 | 53 |
| HD 40216  | 05 55 43.2 | -38 06 16 | 130 | 6483 | 3.34 | 33 |
| V1358 Ori | 06 19 08.1 | -03 26 20 | 170 | 6178 | 3.26 | 36 |
| CD-40 2458| 06 26 06.9 | -41 02 54 | 310 | 5314 | 2.84 | 12 |
| CD-48 2324| 06 28 06.1 | -48 26 53 | 280 | 5383 | 2.85 | 41 |
| TYC 4810-0181-1 | 06 31 55.2 | -07 04 59 | 250 | 4735 | 2.11 | 125 |
| HD 295290 | 06 40 22.3 | -03 31 59 | 330 | 5314 | 2.87 | 39 |
| HD 48370  | 06 43 01.0 | -02 53 19 | 170 | 5663 | 2.85 | 9 |
| CD-36 3202| 06 52 46.7 | -36 36 17 | 300 | 4917 | 2.41 | 170 |
| HD 51797  | 06 56 23.5 | -46 46 55 | 335 | 5390 | 2.95 | 16 |
| HD 62237  | 07 42 26.6 | -16 17 00 | 230 | 6127 | 3.37 |
Table 6. The Carina Association

| Ident | α(2000) | δ(2000) | EW\(_{\text{Li}}\) | T\(_{\text{eff}}\) | X\(_{\text{Li}}\) | v sin(i) |
|-------|---------|---------|----------------|---------------|------------|----------|
|       | mÅ      | K       | km s\(^{-1}\)   |               |            |          |
| HD 42270 | 05 53 29.3 | -81 56 53 | 305 | 4988 | 2.49 | 30 |
| AB Pic | 06 19 12.9 | -58 03 16 | 320 | 5168 | 2.70 | 12 |
| HD 49855 | 06 43 46.2 | -71 58 35 | 233 | 5721 | 3.05 | 12 |
| HD 55279 | 07 00 30.5 | -79 41 46 | 278 | 5036 | 2.49 | 9 |
| CD-57 1709 | 07 21 23.7 | -57 20 37 | 247 | 5225 | 2.63 | 12 |
| CD-63 408 | 08 24 06.0 | -63 34 03 | 205 | 5759 | 3.02 | 73 |
| CD-61 2010 | 08 42 00.5 | -62 18 26 | 275 | 5140 | 2.59 | 38 |
| CD-53 1875 | 08 45 52.7 | -53 27 28 | 170 | 5931 | 3.07 | 45 |
| CD-75 392 | 08 50 05.4 | -75 54 38 | 261 | 5481 | 2.90 | 44 |
| CD-53 2515 | 08 51 56.4 | -53 55 57 | 240 | 5607 | 2.97 | 29 |
| TYC 8582-3040-1 | 08 57 45.6 | -54 08 37 | 320 | 4735 | 2.16 | 24 |
| CD-49 4008 | 08 57 52.2 | -49 41 51 | 260 | 5567 | 2.98 | 33 |
| CD-54 2499 | 08 59 28.7 | -54 46 49 | 240 | 5759 | 3.05 | 128 |
| CP-55 1885 | 09 00 03.4 | -55 38 24 | 250 | 5645 | 3.03 | 44 |
| CD-55 2543 | 09 09 29.4 | -55 38 27 | 200 | 5506 | 2.79 | 15 |
| CD-54 2644 | 09 13 16.9 | -55 29 03 | 240 | 5607 | 2.97 | 40 |
| V479 Car | 09 23 35.0 | -61 11 36 | 345 | 5012 | 2.58 | 15 |
| HD 83096 | 09 31 24.9 | -73 44 49 | 100 | 7116 | 3.57 | 53 |
| HIP 46720B | 09 31 25.2 | -73 44 51 | 240 | 5383 | 2.77 |
| CP-52 2481 | 09 32 26.1 | -52 37 40 | 245 | 5197 | 2.59 | 17 |
| CP-62 1293 | 09 43 08.8 | -63 13 04 | 215 | 5481 | 2.80 | 35 |
| CD-54 4320 | 11 45 51.8 | -55 20 46 | 190 | 4361 | 1.50 | 5 |
| HD 107722 | 12 23 29.0 | -77 40 51 | 80 | 6556 | 3.15 | 30 |
| Intruders | | | | | | |
| CD-48 4797 | 09 33 14.3 | -48 48 33 | 0 | 4226 | 80 |

Table 7. The TW Hydræ Association

| Ident | α(2000) | δ(2000) | EW\(_{\text{Li}}\) | T\(_{\text{eff}}\) | X\(_{\text{Li}}\) | v sin(i) |
|-------|---------|---------|----------------|---------------|------------|----------|
|       | mÅ      | K       | km s\(^{-1}\)   |               |            |          |
| TWA 7 | 10 42 30.1 | -33 40 17 | 530 | 3563 | 0.49 | 4 |
| TWA 1 | 11 01 51.9 | -34 42 17 | 435 | 3973 | 1.26 | 6 |
| TWA 2 | 11 09 13.8 | -30 01 40 | 535 | 3649 | 0.74 | 13 |
| TWA 3B | 11 10 27.8 | -37 31 53 | 580 | 3321 | 0.31 | 12 |
| TWA 3A | 11 10 27.9 | -37 31 52 | 710 | 3376 | 0.49 | 12 |
| TWA 13A | 11 21 17.2 | -34 46 46 | 580 | 3779 | 1.04 | 12 |
| TWA 13B | 11 21 17.4 | -34 46 50 | 550 | 3655 | 0.77 | 12 |
| TWA 4 | 11 22 05.3 | -24 46 40 | 380 | 4209 | 1.74 | 9 |
| TWA 5A | 11 31 55.3 | -34 36 27 | 629 | 3533 | 0.63 | 54 |
| TWA 5B | 11 31 55.4 | -34 36 29 | 300 | 3050 | -0.23 | 16 |
| TWA 8A | 11 32 41.2 | -26 51 56 | 600 | 3514 | 0.58 | 7 |
| TWA 8B | 11 32 41.2 | -26 52 09 | 560 | 3240 | 0.21 | 11 |
| TWA 26 | 11 39 51.1 | -31 59 21 | 500 | 3050 | 0.03 | 25 |
| TWA 9B | 11 48 23.7 | -37 28 48 | 480 | 3458 | 0.37 | 8 |
| TWA 9A | 11 48 24.2 | -37 28 49 | 470 | 4062 | 1.47 | 11 |
| TWA 27 | 12 07 33.4 | -39 32 54 | 500 | 3107 | 0.06 | 13 |
| TWA 25 | 12 15 30.7 | -39 48 43 | 555 | 3742 | 0.94 | 13 |
| TWA 20 | 12 31 38.1 | -45 58 59 | 160 | 3492 | -0.10 | 30 |
| TWA 16 | 12 34 56.4 | -45 38 07 | 360 | 3649 | 0.53 | 11 |
| TWA 10 | 12 35 04.2 | -41 36 39 | 500 | 3492 | 0.44 | 6 |
| TWA 11B | 12 36 00.6 | -39 52 16 | 550 | 3592 | 0.65 | 12 |
| TWA 11A | 12 36 01.0 | -39 52 10 | 0 | 9311 | 152 |
Table 8. The $\epsilon$ Chamaleontis Association

| Ident     | $\alpha$ (2000) | $\delta$ (2000) | EW$_{Li}$ | $T_{eff}$ | $A_{Li}$ | $v\sin(i)$ |
|-----------|-----------------|-----------------|-----------|-----------|----------|------------|
|           | mÅ              | K               |           | km s$^{-1}$ |          |            |
| EG Cha    | 08 36 56.2      | -78 56 46      | 510       | 4268      | 1.86     | 22         |
| $\eta$ Cha | 08 41 19.5      | -78 57 48      | 0         | 11384     | 390      |            |
| RS Cha    | 08 43 12.2      | -79 04 12      | 0         | 8049      |          | 64         |
| EQ Cha    | 08 47 56.8      | -78 54 53      | 570       | 3529      | 0.57     | 15         |
| CP-68 1388 | 10 57 49.4      | -69 14 00      | 420       | 4695      | 2.33     | 26         |
| DZ Cha    | 11 49 31.9      | -78 51 01      | 560       | 3603      | 0.68     | 18         |
| T Cha     | 11 57 13.5      | -79 21 32      | 360       | 5111      | 2.71     | 39         |
| GSC 9415-2676 | 11 58 26.9  | -77 54 45      | 600       | 3486      | 0.53     | 5          |
| EE Cha    | 11 58 35.2      | -77 49 31      | 0         | 8104      | 93       |            |
| $\epsilon$ Cha | 11 59 37.6   | -78 13 19      | 0         | 11384     |          | 265        |
| HIP 58490 | 11 59 42.3      | -76 01 26      | 445       | 4351      | 1.91     | 10         |
| DX Cha    | 12 00 05.1      | -78 11 35      | 0         | 7994      |          | 12         |
| HD 104237D | 12 00 08.3      | -78 11 40      | 580       | 3434      | 0.44     | 6          |
| HD 104237E | 12 00 09.3      | -78 11 42      | 480       | 3850      | 1.08     | 30         |
| HD 104467 | 12 01 39.1      | -78 59 17      | 260       | 5759      | 3.14     | 22         |
| GSC 9420-0948 | 12 02 03.8 | -78 53 01      | 540       | 3661      | 0.77     | 12         |
| GSC 9416-1029 | 12 04 36.2  | -77 31 35      | 470       | 3537      | 0.47     | 6          |
| HD 105923 | 12 11 38.1      | -71 10 36      | 280       | 5344      | 2.81     | 13         |
| GSC 9239-1495 | 12 19 43.8   | -74 03 57      | 560       | 3673      | 0.81     |            |
| GSC 9239-1572 | 12 20 21.9  | -74 07 39      | 610       | 3749      | 1.01     | 41         |
| CD-74 712 | 12 39 21.3      | -75 02 39      | 459       | 4722      | 2.41     | 20         |
| CD-69 1055 | 12 58 25.6      | -70 28 49      | 400       | 4917      | 2.56     | 24         |
| MP Mus    | 13 22 07.5      | -69 38 12      | 424       | 4616      | 2.24     | 14         |

Table 9. The Octans Association

| Ident     | $\alpha$ (2000) | $\delta$ (2000) | EW$_{Li}$ | $T_{eff}$ | $A_{Li}$ | $v\sin(i)$ |
|-----------|-----------------|-----------------|-----------|-----------|----------|------------|
|           | mÅ              | K               |           | km s$^{-1}$ |          |            |
| CD-58 860 | 04 11 55.7      | -58 01 47      | 225       | 5759      | 3.07     | 20         |
| CD-43 1451 | 04 30 27.3      | -42 48 47      | 280       | 5168      | 2.63     | 19         |
| CD-72 248 | 05 06 50.6      | -72 21 12      | 350       | 5059      | 2.58     | 190        |
| HD 274576 | 05 28 51.4      | -46 28 19      | 235       | 5683      | 3.03     | 21         |
| CD-47 1999 | 05 43 32.1      | -47 41 11      | 190       | 6064      | 3.23     | 39         |
| TYC 7066-1037-1 | 05 58 11.8   | -35 00 49      | 250       | 5383      | 2.79     | 20         |
| CD-66 395 | 06 25 12.4      | -66 29 10      | 250       | 5225      | 2.57     | 190        |
| CD-30 3394A | 06 40 04.9      | -30 33 03      | 120       | 6490      | 3.30     | 36         |
| CD-30 3394B | 06 40 05.7      | -30 33 09      | 170       | 6140      | 3.23     | 40         |
| HD 155177 | 17 42 09.0      | -86 08 05      | 80        | 6623      | 3.19     | 21         |
| TYC 9300-0529-1 | 18 49 45.1   | -71 56 58      | 300       | 5140      | 2.64     | 26         |
| TYC 9300-0891-1 | 18 49 48.7   | -71 57 10      | 310       | 5168      | 2.69     | 9          |
| CP-79 1037 | 19 47 03.9      | -78 57 43      | 257       | 5304      | 2.73     | 29         |
| CP-82 784 | 19 53 56.8      | -82 40 42      | 275       | 5012      | 2.46     | 39         |
| CD-87 121 | 23 58 17.7      | -86 26 24      | 266       | 5225      | 2.66     | 34         |
### Table 10. The Argus Association

| Ident | α(2000) | δ(2000) | EW<sub>Li</sub> | T<sub>eff</sub> | A<sub>Li</sub> | v sin(i) |
|-------|----------|----------|----------------|----------------|--------------|-----------|
|   | mÅ       |          |             | °             | km s<sup>-1</sup> |
| BW Phe | 00 56 55.5 | -51 52 32 | 148 | 4826 | 1.96 | 28 |
| CD-49 1902 | 05 49 44.8 | -49 18 26 | 220 | 5645 | 2.96 | 55 |
| CD-56 1438 | 06 11 53.0 | -56 19 05 | 230 | 5225 | 2.59 | 130 |
| CD-28 3434 | 06 49 45.4 | -28 59 17 | 230 | 5607 | 2.95 |
| CD-42 2906 | 07 01 53.4 | -42 27 56 | 275 | 5083 | 2.54 | 11 |
| CD-48 2972 | 07 28 22.0 | -49 08 38 | 250 | 5506 | 2.90 | 52 |
| CD-48 3199 | 07 47 26.0 | -49 02 51 | 230 | 5607 | 2.95 | 25 |
| CD-43 3604 | 07 48 49.8 | -43 27 06 | 320 | 4589 | 2.05 | 40 |
| TYC 8561-0970-1 | 07 53 55.5 | -57 10 07 | 210 | 5225 | 2.55 | 6 |
| HD 67945 | 08 09 38.6 | -20 13 50 | 0 | 7159 | |
| CD-58 2194 | 08 39 11.6 | -58 34 28 | 270 | 5759 | 3.16 | 85 |
| PMM 7422 | 08 28 45.6 | -52 05 27 | 233 | 5683 | 3.02 | 33 |
| PMM 7956 | 08 29 51.9 | -51 40 40 | 289 | 4735 | 2.17 | 14 |
| PMM 1560 | 08 29 52.4 | -52 22 00 | 107 | 5874 | 2.80 | 6 |
| PMM 6974 | 08 34 18.1 | -52 15 58 | 74 | 4633 | 1.42 | 5 |
| PPM 4280 | 08 34 20.5 | -52 50 05 | 151 | 5759 | 2.87 | 16 |
| PPM 6978 | 08 40 20.1 | -52 14 01 | 179 | 5625 | 2.87 | 16 |
| TYC 8561-0058-1 | 09 40 33.5 | -52 56 02 | 230 | 5083 | 2.59 | 25 |
| TYC 6585-0334-1 | 08 56 26.3 | -22 41 40 | 10 | 4226 | -0.06 | 4 |
Table 11. The AB Doradus Association

| Ident    | α(2000)   | δ(2000)   | EW_Li | T_eff | A_Li | v sin(i) |
|----------|-----------|-----------|-------|-------|------|----------|
| PW And   | 00 18 20.9 | +30 57 22 | 267   | 4701  | 2.10 | 22       |
| HD 4277  | 00 45 50.9 | +54 58 40 | 119   | 6521  | 3.32 | 24       |
| HD 6569  | 01 06 26.2 | -14 17 47 | 155   | 5036  | 2.21 | 10       |
| HD 12 243 | 01 20 32.3 | -11 28 04 | 160   | 5432  | 2.62 | 3        |
| CD-46 644 | 02 10 55.4 | -46 03 59 | 250   | 4629  | 1.90 | 36       |
| HD 13482 | 02 12 15.4 | +23 57 29 | 145   | 5597  | 2.65 | 6        |
| HIP 12635 | 02 42 21.0 | +38 37 21 | 146   | 4917  | 2.05 | 6        |
| HD 16760A | 02 42 21.3 | +38 37 07 | 158   | 5829  | 2.96 | 3        |
| HD 17332B | 02 47 27.2 | +19 22 21 | 170   | 5721  | 2.90 | 8        |
| HD 17332A | 02 47 27.4 | +19 22 19 | 155   | 6064  | 3.13 | 13       |
| IS Eri   | 03 09 42.3 | -09 34 47 | 191   | 5383  | 2.66 | 7        |
| HIP 14807 | 03 11 12.3 | +22 25 23 | 34    | 4226  | 0.49 |          |
| HIP 14809 | 03 11 13.8 | +22 24 57 | 145   | 6102  | 3.13 |          |
| CD-12 243 | 03 12 34.3 | +09 44 57 | 150   | 4735  | 1.86 | 6        |
| V577 Per | 03 33 13.5 | +46 15 27 | 200   | 5729  | 2.99 | 7        |
| HD 21845B | 03 33 14.0 | +46 15 19 | 30    | 3831  | -0.28| 20       |
| HIP 17695 | 03 47 23.3 | -01 58 20 | 0     | 3518  |      | 18       |
| HD 24681 | 03 55 20.4 | -01 43 45 | 230   | 5630  | 2.97 | 34       |
| HD 25457 | 04 02 36.7 | -00 16 08 | 100   | 6406  | 3.16 | 18       |
| HD 25953 | 04 06 41.5 | +01 41 02 | 120   | 6521  | 3.32 | 30       |
| TYC 0091-0082-1 | 04 37 51.5 | +05 03 08 | 220   | 5225  | 2.57 | 8        |
| TYC 5899-0026-1 | 04 52 24.4 | -16 49 22 | 20    | 3480  | -1.09| 5        |
| CD-56 1032B | 04 53 30.5 | -55 51 32 | 0     | 3388  |      |          |
| CD-56 1032A | 04 53 31.2 | -55 51 37 | 0     | 3458  |      |          |
| HD 31652 | 04 57 22.3 | -09 08 00 | 230   | 5460  | 2.82 | 6        |
| CD-40 1701 | 05 02 30.4 | -39 59 13 | 120   | 4589  | 1.59 | 7        |
| HD 32981 | 05 06 27.7 | -15 49 30 | 140   | 5905  | 3.03 | 6        |
| HD 293857 | 05 11 09.7 | +23 57 29 | 150   | 4735  | 1.86 | 6        |
| HD 293857 | 05 11 09.7 | +23 57 29 | 150   | 4735  | 1.86 | 6        |
| HD 293857 | 05 11 09.7 | +23 57 29 | 150   | 4735  | 1.86 | 6        |
| HD 293857 | 05 11 09.7 | +23 57 29 | 150   | 4735  | 1.86 | 6        |
| HD 293857 | 05 11 09.7 | +23 57 29 | 150   | 4735  | 1.86 | 6        |
### Table 11. The AB Doradus Association - Continued

| Ident     | α(2000) | δ(2000) | EW Li | T eff | A Li | v sin(i) |
|-----------|---------|---------|-------|-------|------|----------|
|           | mÅ      |         |       | K     |      | km s⁻¹   |
| PX Vir    | 13 03 49.7 | -05 09 43 | 142   | 5197  | 2.33 | 6        |
| HD 139751 | 15 40 28.4 | -18 41 46 | 110   | 4442  | 1.36 | 8        |
| HIP 81084 | 16 33 41.6 | -09 33 12 | 0     | 3879  |      | 7        |
| HD 152555 | 16 54 08.1 | -04 20 25 | 133   | 6102  | 3.08 | 16       |
| HD 317617 | 17 28 55.6 | -32 43 57 | 120   | 4735  | 1.76 | 4        |
| HD 159911 | 17 37 46.5 | -13 14 47 | 250   | 4589  | 1.93 | 140      |
| HD 160934 | 17 38 39.6 | +01 14 16 | 40    | 4226  | 0.57 | 17       |
| HD 176367 | 19 01 06.0 | -28 42 50 | 140   | 6254  | 3.22 | 17       |
| HD 178085 | 19 10 57.9 | -60 16 20 | 165   | 6102  | 3.19 | 24       |
| TYC 0486-4943-1 | 19 33 03.8 | +03 45 40 | 180   | 4735  | 1.95 | 11       |
| HD 189285 | 19 59 24.1 | -04 32 06 | 140   | 5630  | 2.73 | 9        |
| BD-03 4775 | 20 04 49.4 | -02 39 20 | 210   | 6083  | 2.57 | 8        |
| HD 199508 | 20 54 21.1 | +00 02 24 | 160   | 5894  | 3.01 | 14       |
| TYC 1099-0543-1 | 20 54 28.0 | +09 06 07 | 120   | 4589  | 1.59 | 18       |
| HD 201919 | 21 13 05.3 | -17 29 13 | 20    | 4268  | 0.32 | 8        |
| LQ Peg    | 21 31 01.7 | +23 20 07 | 215   | 4524  | 1.78 | 66       |
| HD 207278 | 21 48 48.5 | -39 29 09 | 190   | 5759  | 2.99 | 10       |
| HIP 107948 | 21 52 10.4 | +05 37 36 | 0     | 3486  |      | 80       |
| HIP 110526A | 22 23 29.1 | +32 27 34 | 0     | 3492  |      | 16       |
| HIP 110526B | 22 23 29.1 | +32 27 32 | 0     | 3480  |      |          |
| HD 217343 | 23 00 19.3 | -26 09 14 | 180   | 5912  | 3.09 | 12       |
| HD 217379 | 23 00 28.0 | -26 18 43 | 10    | 4257  | -0.01 | 6       |
| HIP 114066 | 23 06 04.8 | +63 55 34 | 30    | 3879  | -0.18 | 8       |
| HD 218606A | 23 11 52.1 | -45 08 11 | 222   | 5607  | 2.94 | 7        |
| HD 218606B | 23 11 53.6 | -45 08 00 | 0     | 3492  |      |          |
| HIP 115162 | 23 19 39.6 | +42 15 10 | 160   | 5607  | 2.78 |          |
| HD 222575 | 23 41 54.3 | -35 58 40 | 230   | 5567  | 2.92 | 31       |
| HD 224228 | 23 56 10.7 | -39 03 08 | 78    | 4826  | 1.66 | 3        |
| **Intruders** | | | | | | |
| CD-41 2076 | 05 48 30.4 | -41 27 20 | 20    | 4361  | 0.45 | 10       |
| V402 Hya  | 08 53 12.1 | -07 43 21 | 0     | 5111  |      | 240      |
| CD-37 6177 | 09 56 58.4 | -38 33 14 | 0     | 4917  |      |          |
| HD 110810 | 12 45 14.4 | -57 21 29 | 0     | 4964  |      | 4        |