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Elemental abundance analyses with coadded DAO spectrograms – VI. The mercury–manganese stars Nu Cancri, Iota Coronae Borealis and HR 8349

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Summary. The elemental abundances of three mercury–manganese stars ν Cancri, ι Coronae Borealis and HR 8349 were found in a manner consistent with previous analyses of this series. As ι CrB is a double-lined spectroscopic binary with a small velocity amplitude for most of its period, its study required determining whether the observed lines were produced in the primary or secondary or both. The derived abundances and effective temperatures were used with those of mercury–manganese stars previously analysed in this series to extend the study of probable correlations between abundances and with effective temperature and surface gravity in accord with radiative diffusion explanations.

1 Introduction

This paper presents elemental abundance analyses of three additional mercury–manganese stars: ν Cancri, ι Coronae Borealis and HR 8349. Nine such stars are now consistently analysed. Papers II, IV and V (Adelman 1987a, 1988b, 1988c) contain previous analyses of such stars.

Adelman, Young & Baldwin (1984), who found that the elemental abundances of ν Cancri (HR 3595 = HD 77 350) resembled those of the HgMn stars, suggested this star was the coolest known member of that class. Its effective temperature of 10 350 K is slightly cooler than those stars normally considered to be HgMn stars. It may well be a link between the mercury–manganese stars and the slightly cooler hot Am stars. Conti (1965) reviewed the problems of classifying main sequence stars near spectral type A0. About one half of them had anomalous Sc/Sr line strengths as judged by the ratio of Sc II λ4246/Sr II λ4215. Such stars he believed might be hidden analogues of the later type Am stars. Although νCnc was not included in his study, I find Sc/Sr = 1.25. This only slightly anomalous value is still suggestive of mild peculiarities. As ν Cnc is somewhat hotter than the hot Am star prototype o Peg (Adelman 1988a, b – Paper III and Paper IV) and as the abundance anomalies are expected to be functions of temperature, some differences are expected.

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Elemental abundances of HR 8349 (=HD 207 857) were first deduced by Guthrie (1984). It is one of the hottest mercury–manganese stars and shows anomalies typical of the class. Its Hg II λ3984 line was studied by White *et al.* (1976) who also studied the other two stars of this paper.

One of the most thoroughly studied HgMn stars is ιCrB (=HR 5971=HD 143 807). Maestre & Deutsch (1961) published line identifications for ι CrB in both the ultraviolet and photographic regions. Aller & Ross (1970) presented the equivalent widths of the spectral lines which were analyzed by Ross & Aller (1970). Aikman (1976) on the basis of 24 radial velocities concluded that the radial velocity was probably variable. Dworetsky (1980a) found that ι CrB was a double-lined spectroscopic binary with a period of 35.47 d and a very small semi-amplitude $K = 2.3$ km s^{-1}. His work explained observations by several observers of line-profile asymmetries.

2 The spectra

Using the procedures of Paper I (Adelman & Hill 1987) 14, 11 and 11 2.4 Å mm^{-1} IIa-0 baked spectrograms of ν Cnc, ι CrB and HR 8349, respectively, were coadded and measured. Usually rotationally broadened profiles were fitted through the stellar lines of ν Cnc while Gaussian profiles were fitted through the lines of both ι CrB and HR 8349. The resulting estimates of rotational velocity based on clearly single medium strength and strong lines near λ4481 are 13, 5 and 8 km s^{-1} for ν Cnc, ι CrB and HR 8349, respectively. These values include a correction for the instrumental profile. Some recent values in the literature include 23 km s^{-1} for ν Cnc (Hoffleit 1982), 4 km s^{-1} for ι CrB (Dworetsky 1980a) and 14 km s^{-1} for HR 8349 (Guthrie 1984).

A study of the weakest lines which are measured with sufficient accuracy for use in the elemental abundance analyses (see Paper II) yielded the following results for equivalent width and the range of uncorrected FWHM or $v \sin i$: ν Cnc, 3.5 mÅ for lines with $v \sin i$ of 12–24 km s^{-1}, ι CrB, 2.3 mÅ for FWHM between 0.08 and 0.15 Å and HR 8349, 3 mÅ for lines with $v \sin i$ of 10–16 km s^{-1}.

The general references used to identify the stellar lines were *A Multiplet Table of Astrophysical Interest* (Moore 1945) and *Wavelengths and Transition Probabilities for Atoms and Atomic Ions, Part I* (Reader & Corliss 1980). More specialized references included Moore (1965) for Si II and Si III, Svendenius, Magnusson & Zetterberg (1983) for P II, Magnusson & Zetterberg (1977) for P III, Petterson (1983) for S II, Huldt *et al.* (1982) for Ti II, Kiess (1951) and Dworetsky (1971) for Cr II, Catalan, Meggers & Garcia-Riquelme (1964) for Mn I, Iglesias & Velasco (1964) for Mn II, Johansson (1978) and Adelman (1987b) for Fe II, Palmer (1977) for Y II, and Shenstone (1938) for Pt II.

Adelman *et al.* (1984) analyzed ν Cnc with Mt Wilson Observatory 10.4 Å mm^{-1} IIaO spectrograms and found lines of He I, C II, Mg I, Mg II, Al I, Si II, Ca II, Sc II, Ti II, V II, Cr I, Cr II, Mn I, Mn II, Fe I, Fe II, Ni II, Sr II, Y II, Zr II, Ba II, Yb II and Hg II. This study confirms these species identifications except for that of Yb II, which may simply reflect that the current study did not use spectra of the region where the strongest optical region line is found. Ba II λ4554 is probably blended with a Zr II line. Lines of Si I, S II, Ca I, Co I and Gd II were also found.

Maestre & Deutsch (1961) and Aller & Ross (1970) found lines of H I, C II, Na I, Mg I, Mg II, Al I, Si I, Si II, S II, Ca I, Ca II, Sc II, Ti II, V II, Cr I, Cr II, Mn I, Mn II, Fe I, Fe II, Ni I, Ni II, Sr II, Y II, Zr II, Ba II, Hg I and Hg II in the photographic and red spectrum of ι CrB. This study also found lines of P II, Ti I, Fe III, Co I, La II, Gd II and Pt II. The presence of Co I and La II

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lines is considered to be tentative, especially as the former gave a very large abundance (see below).

Guthrie (1984) identified lines of Mg II, P II, Sc II, Ti II, Cr II, Mn II, Fe II and Y II in HR 8349. This study also found lines of He I, C II, O II, Mg I, Al I, Si II, Si III, P III, S II, Ca II, Mn I, Fe I, Fe III, Ni II, Sr II, Zr II, Gd II, Pt II, Hg I and Hg II. The possible presence of O II and Gd II lines is quite unusual and indicates large overabundances. Aikman (1976), on the basis of 13 spectrograms, found a mean radial velocity of -5.62 km s^{-1} and noted that this star was probably a velocity variable.

The radial velocities of the coadded spectrograms were found from a comparison of the stellar and laboratory wavelengths. In the reduction process corrections were applied for the Earth's orbital velocity. The results were -14.81 ± 1.91 km s^{-1} from 14 plates for ν Cnc, -20.78 ± 0.63 km s^{-1} from 11 plates for ι CrB and -3.68 ± 6.10 km s^{-1} from 11 plates for HR 8349. For ν Cnc and HR 8349 eliminating one spectrogram from the averages reduced the values to -14.30 ± 0.23 km s^{-1} and -5.52 ± 0.24 km s^{-1}, respectively. These latter values are indicative of constancy. That there is a discrepant value for each of these stars suggests that further observations should be made. For HR 8349 this result supports Aikman's suggestion that this star might be a spectroscopic binary. The derived values of the radial velocities for ν Cnc and ι CrB are within the range of values reported by Abt & Biggs (1972) for these stars.

One hundred equivalent widths of the coadded spectrum of ν Cnc were compared with those obtained by averaging two 10.4 Å mm^{-1} well widened Mt Wilson Observatory spectrograms (Adelman, Young & Baldwin 1984). The least squares solution in mÅ

$$W_\lambda(\text{DAO}) = 0.686\, W_\lambda(\text{Mt Wilson}) - 1.17$$
$$\pm 0.034 \qquad\qquad \pm 2.32$$

is consistent with the DAO material having a higher signal-to-noise ratio and a slight difference in the continuum level. A similar comparison for 32 equivalent widths of HR 8349 measured on 6 Å mm^{-1} spectrograms taken with the Edinburgh 0.9-m telescope by Guthrie (1984) gave a somewhat similar result

$$W_\lambda(\text{DAO}) = 0.762\, W_\lambda(\text{Guthrie}) - 2.20$$
$$\pm 0.061 \qquad\qquad \pm 3.58.$$

Comparison of 100 equivalent widths of ι CrB of this paper with those measured on three 2.2 Å mm^{-1} Lick Observatory coude spectrograms by Aller & Ross (1970) gave

$$W_\lambda(\text{DAO}) = 0.663\, W_\lambda(\text{A\&R}) + 7.65$$
$$\pm 0.043 \qquad\qquad \pm 2.10$$

while of 48 equivalent widths of ι CrB of this paper with those measured on 5.3 Å mm^{-1} Okayama Astrophysical Observatory spectrograms by Kodaira & Takada (1978) gave

$$W_\lambda(\text{DAO}) = 0.894\, W_\lambda(\text{K\&T}) + 0.19$$
$$\pm 0.071 \qquad\qquad \pm 0.37.$$

As we are comparing similar dispersion material for 11 DAO with three Lick plates, we would expect the coefficient of the W_λ term to be close to unity. That this is not so suggests that the calibration of the Lick plates is questionable and/or that the continuum was drawn too high by Aller & Ross. The comparison with the Kodaira & Takada values indicates better average agreement although the differences between individual values can be considerable. The average agreement is slightly better than that for μ Lep and for κ Cnc (Paper II) and quite similar to that for ϕ Her (Paper V).

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3 The abundance analyses

Optical region spectrophotometry of ν Cnc (Adelman 1981) and the Hγ profile as derived from the coadded spectrograms were compared with the predictions of LTE model atmospheres calculated with the ATLAS6 program (Kurucz 1979). Table 2 shows the agreement of the predicted and observed Hγ profiles which are averages of both wings with a correction applied for scattered light. The adopted values for ν Cnc are $T_{\rm eff}=10\,375$ K, $\log g=3.50$ which compare with $T_{\rm eff}=10\,375$ K, $\log g=3.60$ (Adelman *et al.* 1984).

For ι CrB the secondary complicates the analysis. Dworetsky (1980a) found the luminosity ratio was $L_{\rm p}/L_{\rm s}=3$–4. He used $T_{\rm eff}=11\,000$ K for the primary and $T_{\rm eff}=9000$ K for the secondary. I adopted a luminosity ratio of 4 following Leckrone (1984) and Dworetsky's temperature difference of 2000 K and simultaneously fit the optical region spectrophotometry (Adelman & Pyper 1979) and the Hγ profile derived from the coadded spectrograms. This process converged relatively rapidly. For the primary I found $T_{\rm eff}=11\,250$ K, $\log g=3.65$ and for the secondary $T_{\rm eff}=9250$, $\log g=4.0$. The adopted $\log g$ of the secondary better fits the Hγ profile towards the core than models with smaller $\log g$ values. Leckrone (1984) found $T_{\rm eff}=11\,380$ K, $\log g=3.8$ for the primary while Ross & Aller (1970) $T_{\rm eff}=11\,000$ K, $\log g=3.70$.

For HR 8349 as no spectrophotometric observations were available, Guthrie's (1984) estimates of the effective temperature (13 200 K) and surface gravity ($\log g=3.5$), as derived from a comparison of observed photometric values and those synthesized from Kurucz models, were used as an initial guess. To them were applied the mean offsets between my values found for other stars of this series and those of Guthrie. This gave $T_{\rm eff}=12\,975$ K,

Table 1. Hγ profiles.

	ν Cnc		ι CrB		HR 8349	
Δλ(Å)	observed	model	observed	model	observed	model
0	0.228	0.166	0.180	0.166	0.249	0.241
1	0.390	0.333	0.380	0.349	0.390	0.426
2	0.460	0.405	0.442	0.420	0.494	0.502
3	0.519	0.472	0.501	0.486	0.521	0.570
4	0.571	0.536	0.555	0.546	0.613	0.631
5	0.627	0.596	0.609	0.602	0.680	0.685
6	0.674	0.652	0.669	0.651	0.734	0.732
7	0.714	0.698	0.696	0.691	0.780	0.769
8	0.748	0.744	0.736	0.733	0.816	0.806
9	0.786	0.778	0.764	0.762	0.849	0.832
10	0.814	0.812	0.798	0.795	0.869	0.858
12	0.859	0.860	0.842	0.840	0.893	0.895
14	...	0.895	0.875	0.874	0.925	0.921
16	0.911	0.919	0.902	0.899	...	0.939
18	0.931	0.937	0.922	0.919	0.963	0.952
20	0.944	0.950	0.936	0.934	0.962	0.962
22	0.956	0.959	0.946	0.946	0.971	0.969
24	0.964	0.967	0.956	0.955	0.974	0.975
26	0.968	0.972	0.963	0.962	0.979	0.979
28	...	0.977	0.969	0.968	0.985	0.983
30	0.985	0.980	0.975	0.972	0.988	0.985
32	0.983	0.983	0.978	0.976	0.993	0.987
34	0.985	0.987	0.981	0.979	0.990	0.988
36	0.989	0.990	0.984	0.982	...	0.990
38	0.987	0.992	0.987	0.984	0.994	0.992
40	0.983	0.993	0.990	0.986	0.992	0.993

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log $g = 3.40$. But to fit the Hγ profile a slightly larger value of log g was required. The adopted values are $T_{\rm eff} = 12\,975$ K, log $g = 3.80$ for HR 8349.

The Hγ profiles were calculated from the model atmospheres using program BALMER6 (Peterson & Kurucz, private communication) while programs OMEGA (Shipman, private communication; Shipman & Strom 1970) and WIDTH6 (Kurucz, private communication) were used to determine the helium and metal abundances, respectively. The adopted metal line damping constants were semi-classical approximations except for those of neutral and singly-ionized Ca–Ni lines where values based on the data of Kurucz (1989, private communication), for lines of C II multiplet 6 and Mg II multiplet 4 where the adopted values for the Stark broadening were based on data of Sahal-Brechot (1969), and Si II multiplets 1 and 3 where the damping constants are those of Lanz, Dimitrijevic & Artru (1988).

The analyses of the two apparently single stars ν Cnc and HR 8349 proceeded without complications. But depending on the atomic species, it can be easy or quite difficult to decide whether a line is produced in the primary, the secondary, or in both stars of the ι CrB system. Thus an iterative procedure was used. Coaddition tends to redistribute the contribution of the secondary lines relative to the position of the primary lines. I assumed that the abundances of the secondary were initially solar and that this star had a microturbulence initially of 1.7 km s^{-1} which was later changed to the derived value of 2.1 km s^{-1} from Fe I lines. Then I calculated the equivalent widths and corrected the observed lines for the contribution of the secondary. These equivalent widths were corrected for dilution by the secondary and assumed to be the equivalent widths of the lines produced in the primary. If the lines were mainly produced in the secondary, an analogous procedure was used assuming initially solar abundances for the primary. The final abundances for those species in which the neutral species is produced primarily in the secondary and the singly-ionized lines in the primary were iterated for consistency in correcting for contributions due to the other star.

As none of the spectrograms used in the coaddition showed the secondary spectrum as clearly as did the example shown by Dworetsky (1980a), this self-consistency method was used to derive the undiluted equivalent widths. This analysis due to the complications of the secondary cannot be regarded as of as high a quality as those of the other stars of this series. It is somewhat dependent on the luminosity ratio, particularly for some atomic species. The abundances derived for the secondary are less certain than those of the primary. In some cases the lines could be produced on either or both stars and a tentative result is not possible, e.g. Al I, Ti I and Sc II. This can result from non-solar abundance values for the secondary, an incorrect luminosity ratio, and/or an incorrect model of the secondary. This method finds that about half of the observed Ni II line equivalent widths are produced in the primary while Dworetsky (1980a) attributes such lines to the secondary as he also does for Al I. A few lines in the observed spectrum are marginally wider than others. Reticon observations should help to clarify this situation especially those taken when the lines from the primary and secondary show the greatest radial velocity shifts.

The abundances of the primary were derived assuming the minimal probable influence of the secondary. It is important to determine a more accurate and precise value of the luminosity ratio. One way might be to model the ultraviolet fluxes and then obtain UV spectra which were much less contaminated by the cooler secondary. This would give better estimates of the primary's abundances which could then be used in the optical region analysis. But this requires the use of the next generation of model atmospheres now being calculated by Kurucz with a more realistic distribution of line opacity and microturbulence.

Instead of assuming that the secondary had solar abundances, one could assume that its abundances were similar to those of other presumably normal stars with identical effective temperatures and surface gravities. This requires having several stars analysed with

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appropriate temperatures and surface gravities. At present only θ Leo, whose abundances show some resemblances to the Am stars, has been so studied. If ι CrB secondary had abundances similar to those of θ Leo (Paper IV), then the corrections applied for the secondary's contributions of atomic species beyond the iron peak would have to be increased and the derived abundances would be decreased.

Abundances were derived from Fe I and Fe II lines for a range of possible microturbulent velocities (ξ). The adopted values (Table 2) result in the derived abundances being independent of the equivalent width. The procedure of Adelman & Fuhr (1985) was followed in looking at both lines with gf-values only in Fuhr, Martin & Wiese (1988) and also with those

Table 2. Determination of the microturbulent velocity from iron lines.

Star	Species	Number of Lines	ξ (km/s)	log Fe/H	gf-values	ξ (km/s) min.scatter
ν Cnc	Fe I	84	0.00	-4.43±0.24	MF & KX	0.0
		75	0.00	-4.44±0.22	MF	0.0
	Fe II	74	0.48	-4.63±0.23	MF & KX	0.0
		36	0.00	-4.59±0.18	MF	0.0
	adopted		0.1			
ι CrB						
primary	Fe II	117	0.00	-4.42±0.25	MF & KX	0.0
		44	0.40	-4.47±0.20	MF	0.4
	adopted		0.2			
secondary	Fe I	109	2.09	-4.40±0.25	MF & KX	2.1
		90	2.08	-4.42±0.25	MF	2.1
	adopted		2.1			
HR 8349	Fe II	88	0.75	-4.47±0.21	MF & KX	0.6
		42	0.63	-4.45±0.18	MF	0.4
	adopted		0.7			

Table 3. Microturbulent velocities from non-iron lines.

Star	Species	Number of Lines	ξ (km/s)	log N/H
ν Cnc	Ti II	65	0.0	-6.38±0.24
	Cr II	40	0.0	-5.88±0.21
	Mn II	11	0.0	-5.88±0.29
	Y II	15	0.0	-7.76±0.19
	Zr II	24	0.0	-7.60±0.09
ι CrB	Ti II	46	0.0	-6.71±0.23
(primary)	V II	13	1.1	-7.57±0.19
	Cr II	43	0.0	-6.01±0.22
	Mn I	14	0.0	-5.13±0.26
	Mn II	68	1.6	-5.16±0.25
	Y II	19	0.0	-7.41±0.21
	Zr II	24	1.0	-7.56±0.13
HR 8349	P II	10	2.0	-4.71±0.16
	Ti II	26	0.5	-6.85±0.21
	Cr II	22	0.6	-6.11±0.36
	Mn I	10	0.0	-4.27±0.18
	Mn II	89	1.4	-4.22±0.26
	Y II	17	0.0	-7.14±0.21
	Zr II	17	>2.0	

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with gf-values in compatible sources, in this case Kurucz (private communication). Also given are the values determined by minimizing the rms scatter of the abundances derived from lines of Fe I and Fe II (Blackwell, Shallis & Simmons 1982). These values generally agree quite well with those derived by requiring that the abundances are independent of equivalent width. For HR 8349 they indicate a slightly lower microturbulence (0.2 km s^{-1}) which if adopted would have only a minimal impact on the derived abundances. Also of interest are the microturbulences derived from other atomic species by requiring that the abundances be independent of equivalent width (see Table 3). For ν Cnc, they all agree with the results from Fe I and Fe II while for the other two stars we see some scatter with the mean for HR 8349 in accord. For ιCrB primary three of the seven species indicate a larger microturbulence. But residual contributions from the secondary may be causing difficulties.

Table 4. He/H ratios.

	Star		
λ(Å)	ν Cnc	ι CrB (primary)	HR 8349
4472	0.024	0.015	0.015
4026	0.030	0.015:	0.020
4388	...	0.015	0.022
Average	0.027	0.015	0.019

The helium abundances (Table 4) were found by comparing the line profiles with theoretical predictions which were convolved with the rotational velocity and the instrumental profile. As these values indicate the stars are helium poor and are not identical to those of the adopted model atmospheres, we must apply a correction to the values of log g (see, e.g. Auer *et al.* 1966). Thus log $g = 3.59$ for ν Cnc, 3.75 for ι CrB (primary), and 3.90 for HR 8349.

The analyses of the line spectra of ν Cnc, ι CrB (primary) and HR 8349 are given in Table 5 with entries for each line giving the multiplet number (Moore 1945), the laboratory wavelength, the logarithm of the gf-value and its source, the equivalent width in mÅ, and the deduced abundance. Also included is the analysis of Fe I in ι CrB (secondary). For the primary

Table 5. Abundances from metallic lines.

				ν Cnc		ι CrB(primary) observed	ι CrB(primary) inferred		HR 8349	
Mult.	λ(Å)	log gf	Ref.	W_λ(mÅ)	log N/H	W_λ(mÅ)	W_λ(mÅ)	log N/H	W_λ(mÅ)	log N/H
C II			log C/H = -3.88					-4.01±0.17		-3.54±0.28
4	3920.68	-0.24	WS	...	...	...	...	...	42	-3.52
	3918.98	-0.54	WS	6	-3.90	7	8	-4.04	22	-3.83
6	4267.15	+0.97	WS	16	-3.86	...	...	...	78	-3.27
	4267.25	+0.73	WS	...	...	11	13	-4.16	...	...
	4267.02	+0.58	WS	...	...	14	17	-3.82	...	...
O II			log O/H =	...				...		-2.59±0.23
2	4317.14	-0.32	WS	...	...	...	...	...	4	-2.64
5	4414.91	+0.30	WM	...	...	...	...	...	6	-2.79
15	4590.97	+0.45	WS	...	...	...	...	...	4	-2.33
Mg I			log Mg/H = -4.66					...		-5.27
3	3838.29	+0.48	WM	...	...	...	...	...	8	-5.39
	3829.35	-0.21	WS	46	-5.01§	...	...	...	3	-5.15
15	4167.15	-0.81	SC	9	-4.49	...	...	...	...	...

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Table 5 – *continued*

				ν Cnc		ι CrB(primary) observed		ι CrB(primary) inferred		HR 8349	
Mult.	λ(Å)	log gf	Ref.	W_λ(mÅ)	log N/H	W_λ(mÅ)	W_λ(mÅ)	log N/H	W_λ(mÅ)	log N/H
Mg II				log Mg/H = -4.71±0.08				-4.84±0.12		-4.94±0.11
4	4481.23	+0.97	WM	273	-4.77	...	...	...	226	-4.80
5	3848.24	-1.60	WM	27	-4.62	12	13	-5.00	12	-4.84
	3850.39	-1.88	WM	11	-4.85	12	13	-4.71	4	-5.10
9	4433.99	-0.90	WS	26	-4.71	...	...	...	...	...
	4428.00	-1.20	WS	17	-4.68	12	13	-4.81	7	-5.00
10	4390.58	-0.53	WS	45	-4.67	38	36	-4.85	25	-5.00
	4384.64	-0.78	WM	33	-4.68	...	...	...	20	-4.89
Al I				log Al/H = -6.38				...		-6.29
1	3944.01	-0.64	WS	17	-6.23	...	...	...	...	...
	3961.52	-0.34	WS	17	-6.52	...	...	...	4	-6.29
Si I				log Si/H = -4.78				...		...
3	3905.53	-1.09	WM	32	-4.78	...	...	...	...	...
Si II				log Si/H = -4.59±0.24				-4.51±0.19		-4.16±0.11
1	3856.02	-0.49	LA	125	-4.51	120	115	-4.67	144	-4.26
	3862.59	-0.74	LA	93	-4.82	107	104	-4.61	128	-4.22
	3853.66	-1.44	LA	58	-4.87	72	74	-4.54	95	-4.12
3	4130.89	+0.53	LA	117	-4.37	111	111	-4.52	149	-4.20
	4128.07	+0.38	LA	103	-4.40	122	127	-4.19	153	-3.99
Si III				log Si/H = ...				...		-4.26±0.05
1	4552.62	+0.29	WS	...	...	...	...	...	13	-4.21
	4567.87	+0.07	WS	...	...	...	...	...	9	-4.26
	4574.76	-0.41	WS	...	...	...	...	...	4	-4.31
P II				log P/H = ...				-5.69±0.07		-4.65±0.16
5	4420.71	-0.34	WM	...	...	...	...	...	36	-4.64
11	4499.24	+0.47	WM	...	...	3	4	-5.69	37	-4.45
15	4602.08	+0.74	WM	...	...	8	10	-5.62	44	-4.69
	4588.04	+0.58	WM	...	...	5	6	-5.79	...	...
	4626.70	-0.31	WM	...	...	...	...	...	14	-4.66
24	4475.27	+0.44	WM	...	...	3	4	-5.67	33	-4.65
	4417.34	-0.32	WM	...	...	...	...	...	7	-5.01
25	4463.02	-0.09	WS	...	...	...	...	...	21	-4.53
	4483.69	-0.78	WS	...	...	...	...	...	7	-4.54
	4530.82	+0.19	WM	...	...	...	...	...	20	-4.84
	4565.29	-0.52	WS	...	...	...	...	...	11	-4.49
P III				log P/H = ...				...		-4.88±0.12
1	4059.31	-0.05	WM	...	...	...	...	...	10	-4.95
	4080.84	-0.31	WM	...	...	...	...	...	7	-4.95
3	4222.15	+0.19	WM	...	...	...	...	...	14	-4.74
S II				log S/H = -5.05±0.11				-4.79±0.26		-5.08±0.18
40	4524.95	+0.17	WM	...	...	7	8	-4.45	6	-5.22
41	3783.16	-0.89	WS	...	...	2	2	-4.55	...	...
44	4162.70	+0.78	WS	5	-5.11	8	10	-4.97	13	-5.19
	4153.10	+0.62	WS	4	-5.12	6	7	-5.07	13	-5.06
	4145.10	+0.44	WS	...	...	7	8	-4.82	...	...
	4122.26	+0.24	WS	...	...	...	...	...	6	-5.17
	4189.68	-0.04	WS	...	...	...	...	...	9	-4.62
	4168.37	-0.16	WS	...	...	2	2	-4.97	4	-4.97
45	4028.75	0.00	WS	...	...	...	...	...	4	-5.14
49	4294.43	+0.56	WS	...	...	3	4	-5.16	...	...
50	3892.32	-0.06	WS	...	...	5	6	-4.51	...	...
55	3932.90	+0.58	WS	...	...	...	...	...	10	-5.12
	3923.46	+0.44	WS	4	-4.93	...	...	...	7	-5.23
59	3998.79	+0.05	WS	...	...	4	5	-4.64	...	...
Ca I				log Ca/H = -6.21				...		...
1	4226.73	+0.24	WS	7	-6.21	...	...	...	...	...
Ca II				log Ca/H = -6.06				-5.07		-4.95
1	3933.66	+0.13	WM	296	-6.06	471	475	-5.07	238	-4.95

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Table 5 – *continued*

					ν Cnc		ι CrB(primary)			HR 8349	
						observed		inferred			
Mult.	λ(Å)	log gf	Ref.	W_λ(mÅ)	log N/H	W_λ(mÅ)		W_λ(mÅ)	log N/H	W_λ(mÅ)	log N/H
Sc II				log Sc/H =	-8.19±0.18				...		-7.67±0.10
7	4246.83	+0.37	WF	65	-8.46	...		...	...	...	...
14	4374.46	-0.39	WF	51	-7.95	...		...	...	14	-7.71
	4400.36	-0.51	WF	36	-8.21	...		...	...	14	-7.60
	4415.56	-0.64	WF	28	-8.28	...		...	...	9	-7.70
	4431.90	-1.88	WF	4	-8.06	...		...	...	...	...
	4354.61	-1.56	WF	7	-8.11	...		...	...	...	...
15	4314.08	-0.40	WF	44	-8.48	...		...	...	22	-7.80
	4320.74	-0.21	WF	46	-8.26	...		...	...	19	-7.73
	4294.77	-1.28	WF	14	-8.05	...		...	...	...	...
	4305.72	-1.22	WF	15	-8.08	...		...	...	4	-7.51
Ti II				log Ti/H =	-6.38±0.24				-6.72±0.23		-6.86±0.21
11	3987.61	-2.73	MF	16	-6.35	...		...	...	...	...
	3981.99	-2.53	KX	21	-6.41	7		5	-6.74	...	...
	4025.14	-1.98	MF	47	-6.26	14		7	-7.12	...	...
	4012.37	-1.61	MF	...	...	34		26	-6.78	...	...
	4056.19	-3.26	KX	12	-5.98	...		...	...	...	...
12	3774.65	-2.73	MF	...	...	4		4	-6.63	...	...
	3813.39	-2.02	MF	39	-6.41	16		12	-6.80	...	...
	3814.58	-1.72	MF	48	-6.49	25		18	-6.89	...	...
13	3759.30	+0.20	MF	92	-6.90	...		...	...	70	-6.65
	3761.33	+0.10	MF	105	-6.46	...		...	...	54	-7.04
18	4469.12	-2.87	KX	15	-6.00	...		...	...	...	...
	4500.37	-3.09	KX	6	-6.25	...		...	...	...	...
19	4395.03	-0.66	MF	73	-6.55	60		50	-6.85	20	-6.95
	4443.80	-0.70	MF	66	-6.76	52		52	-6.77	14	-7.12
	4450.49	-1.45	MF	47	-6.56	22		13	-7.10	4	-6.98
20	4294.09	-1.11	MF	...	...	...		...	...	14	-6.71
	4344.30	-2.09	MF	22	-6.55	4		4	-7.05	...	...
	4287.89	-2.20	MF	39	-6.18	13		10	-6.67	...	...
21	4161.52	-2.36	MF	34	-5.96	8		6	-6.57	...	...
30	4545.14	-2.78	KX	14	-6.10	4		4	-6.33	...	...
31	4468.49	-0.60	MF	67	-6.79	54		43	-7.08	17	-7.09
	4501.27	-0.75	MF	66	-6.68	51		40	-7.02	12	-7.13
34	3900.56	-0.45	MF	85	-6.26	68		62	-6.63	28	-6.91
	3913.46	-0.53	MF	82	-6.29	69		62	-6.55	25	-6.91
	3932.01	-1.78	MF	48	-6.13	18		13	-6.72	4	-6.62
	3882.28	-1.71	MF	30	-6.67	...		...	...	...	...
39	4583.41	-2.72	MF	7	-6.50	...		...	...	...	...
40	4441.73	-2.41	MF	16	-6.37	...		...	...	...	...
	4470.86	-2.28	MF	26	-6.21	...		...	...	...	...
	4417.72	-1.43	MF	53	-6.36	30		23	-6.75	7	-6.70
	4464.46	-2.08	MF	37	-6.13	13		11	-6.52	...	...
41	4300.05	-0.77	MF	77	-6.29	62		55	-6.56	12	-7.08
	4290.22	-1.12	MF	...	...	49		43	-6.54	20	-6.45
	4301.93	-1.16	MF	62	-6.36	33		24	-6.99	8	-6.90
	4312.86	-1.16	MF	63	-6.33	32		23	-7.00	13	-6.65
	4314.98	-1.13	MF	60	-6.46	36		27	-6.94	...	...
	4330.71	-2.04	MF	24	-6.49	...		...	...	...	...
	4320.96	-1.87	MF	36	-6.36	10		5	-7.10	...	...
50	4533.97	-0.77	MF	69	-6.50	54		45	-6.80	20	-6.77
	4563.76	-0.96	MF	60	-6.61	48		39	-6.78	10	-6.97
51	4399.77	-1.27	MF	54	-6.46	28		20	-6.95	6	-6.90
	4394.06	-1.59	MF	38	-6.56	...		...	...	...	...
	4418.34	-2.40	MF	27	-6.02	8		7	-6.32	...	...
60	4544.02	-2.40	MF	8	-6.71	...		...	...	...	...
	4568.31	-2.65	MF	7	-6.53	...		...	...	...	...
61	4395.85	-2.17	MF	30	-6.17	12		11	-6.38	...	...
	4409.24	-2.29	KX	9	-6.75	...		...	...	...	...
	4411.92	-2.12	KX	11	-6.86	...		...	...	...	...
72	3741.64	-0.11	MF	74	-6.66	64		61	-6.74	24	-7.14
	3757.70	-0.46	MF	70	-6.45	46		42	-6.97	12	-7.20
	3776.06	-1.34	MF	36	-6.61	14		12	-6.96	...	...
82	4549.62	-0.45	MF	...	...	69		62	-6.44	...	...
	4571.97	-0.53	MF	72	-6.46	62		54	-6.63	21	-6.82
	4529.46	-2.03	MF	33	-6.05	11		10	-6.39	...	...
87	4028.33	-1.00	MF	54	-6.31	29		23	-6.77	9	-6.66
	4053.81	-1.21	MF	48	-6.28	24		19	-6.68	...	...
93	4421.95	-1.77	MF	27	-6.18	...		...	...	...	...
94	4350.83	-1.40	MF	20	-6.74	...		...	...	...	...
	4316.81	-1.42	MF	27	-6.53	...		...	...	...	...
	4330.24	-1.51	MF	20	-6.64	...		...	...	...	...
104	4367.65	-1.27	MF	42	-6.00	16		15	-6.40	...	...
	4386.86	-1.26	MF	40	-6.06	14		12	-6.53	...	...

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Table 5 – *continued*

					ν Cnc		ι CrB(primary)			HR 8349	
							observed	inferred			
Mult.	λ(Å)	log gf	Ref.	W_λ(mÅ)	log N/H		W_λ(mÅ)	W_λ(mÅ)	log N/H	W_λ(mÅ)	log N/H
Ti II (continued)											
105	4163.64	-0.40	MF	61	-6.31		48	44	-6.46	11	-6.84
	4174.05	-1.25	MF	23	-6.49		...	...	...	...	...
106	4064.35	-1.71	KX	7	-6.67		4	4	-6.60	...	...
107	3761.88	-0.61	MF	64	-5.94		...	...	...	11	-6.62
115	4488.32	-0.82	MF	41	-6.17		18	15	-6.57	...	...
	4456.65	-1.66	KX	10	-6.26		4	4	-6.39	...	...
	4411.08	-1.06	MF	37	-6.04		13	12	-6.47	4	-6.43
H	4158.27	-0.48	KX	13	-6.03		...	...	...	...	...
V II			log V/H = -8.20						-7.56±0.19		...
9	3997.13	-1.62	YF	...	...		3	2	-7.83	...	...
	4002.94	-1.81	YF	...	...		5	5	-7.25	...	...
10	3951.97	-1.26	YF	...	...		8	8	-7.54	...	...
	3916.42	-1.58	YF	...	...		6	6	-7.39	...	...
11	3903.27	-1.20	YF	...	...		6	5	-7.83	...	...
21	3760.24	-1.29	YF	...	...		6	6	-7.53	...	...
32	4005.71	-0.76	YF	5	-8.38		14	12	-7.67	...	...
	4023.39	-0.88	YF	...	...		12	11	-7.60	...	...
	4035.63	-0.96	YF	7	-8.03		14	13	-7.44	...	...
33	3878.70	-0.78	YF	...	...		12	11	-7.66	...	...
	3899.14	-0.93	YF	...	...		8	7	-7.77	...	...
100	3787.24	-0.62	KX	...	...		11	11	-7.47	...	...
	3767.72	-1.32	YF	...	...		3	4	-7.27	...	...
Cr I			log Cr/H = -5.73±0.06						...		
1	4254.35	-0.11	YF	25	-5.66		...	...	...	...	...
	4274.80	-0.23	YF	18	-5.75		...	...	...	...	...
	4289.72	-0.36	YF	14	-5.77		...	...	...	...	...
Cr II			log Cr/H = -5.88±0.21						-6.01±0.22		-6.11±0.23
6	3769.32	-3.56	KX	...	...		5	6	-5.60	...	...
11	3761.68	-2.51	KX	...	...		14	14	-6.14	...	...
18	4111.01	-1.82	KX	36	-6.18		20	19	-6.35	...	...
	4215.76	-2.63	KX	16	-5.95		6	5	-6.34	...	...
19	4054.10	-2.48	KX	25	-5.81		14	13	-6.01	9	-5.71
	4087.63	-3.09	KX	4	-6.18		...	...	...	...	...
	4077.51	-2.78	KX	22	-5.60		7	7	-6.03	...	...
	4051.97	-2.19	KX	30	-5.96		20	18	-6.12	4	-6.44
20	3738.38	-1.97	KX	...	...		...	...	...	11	-6.16
	3754.59	-2.19	KX	36	-5.79		15	17	-6.14	14	-5.81
	3765.58	-2.50	KX	...	...		...	...	...	7	-5.85
26	4072.56	-2.41	KX	16	-5.83		9	10	-5.90	...	...
	4132.41	-2.27	KX	19	-5.84		9	8	-6.07	3	-6.11
	4207.35	-2.47	KX	9	-6.02		4	4	-6.24	...	...
	4086.14	-2.42	KX	15	-5.86		6	6	-6.15	...	...
31	4261.92	-1.51	KX	52	-5.60		39	39	-5.78	23	-5.84
	4275.57	-1.71	KX	41	-5.74		30	30	-5.86	15	-5.91
	4284.21	-1.86	KX	42	-5.56		24	24	-5.87	5	-6.32
	4252.62	-2.02	KX	32	-5.67		18	18	-5.89	7	-6.00
	4269.28	-2.17	KX	27	-5.66		14	14	-5.89	7	-5.85
44	4558.66	-0.42	KX	79	-5.75		70	64	-6.03	48	-6.18
	4588.22	-0.59	KX	60	-6.17		62	57	-6.10	...	...
	4618.82	-0.79	KX	53	-6.20		52	48	-6.17	21	-6.53
	4634.10	-0.98	KX	47	-6.18		44	39	-6.23	24	-6.26
	4555.02	-1.25	KX	41	-6.08		34	31	-6.18	...	...
	4592.09	-1.19	KX	42	-6.11		36	32	-6.21	17	-6.26
	4616.64	-1.33	KX	39	-6.05		32	30	-6.12	15	-6.29
117	3737.55	-1.45	KX	...	...		10	12	-6.22	...	...
129	3911.32	-2.06	KX	12	-5.68		6	6	-5.88	...	...
130	3866.01	-2.35	KX	...	...		5	6	-5.60	...	...
162	4145.77	-1.16	KX	32	-5.73		24	25	-5.79	14	-5.82
165	4082.30	-1.23	KX	12	-6.30		8	7	-6.44	3	-6.50
166	4017.96	-2.42	KX	4	-5.65		3	4	-5.51	...	...
167	3905.64	-0.90	KX	26	-6.15		30	32	-5.85	...	...
179	4362.93	-1.89	KX	8	-5.67		6	6	-5.69	...	...
180	4222.00	-1.93	KX	11	-5.47		...	...	...	...	...
183	3979.51	-0.73	KX	32	-5.97		23	25	-6.04	11	-6.22
	4022.36	-2.02	KX	5	-5.77		4	5	-5.65	...	...
191	4465.77	-1.18	KX	8	-5.93		4	4	-6.17	...	...
192	4256.17	-1.39	KX	8	-5.74		4	5	-5.86	...	...
193	4070.90	-0.75	KX	21	-5.84		16	18	-5.84	8	-5.99
	4049.14	-0.86	KX	14	-5.98		8	8	-6.17	...	...

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Table 5 – *continued*

Mult.	λ(Å)	log gf	Ref.	ν Cnc W_λ(mÅ)	ν Cnc log N/H	ι CrB(primary) observed W_λ(mÅ)	ι CrB(primary) inferred W_λ(mÅ)	ι CrB(primary) log N/H	HR 8349 W_λ(mÅ)	HR 8349 log N/H
Cr II (continued)										
194	4038.03	-0.56	KX	24	-5.94	18	19	-5.99	8	-6.18
	4003.33	-0.60	KX	23	-5.93	14	14	-6.14	7	-6.21
-	3778.69	-2.20	KX	...	...	5	6	-5.71	...	...
	3814.00	-1.03	KX	25	-5.55	...	...	...	...	...
	4306.95	-1.19	KX	12	-6.05	5	5	-6.37	...	...
	4587.30	-1.55	KX	...	...	2	2	-6.11	...	...
Mn I				log Mn/H = -6.21±0.13				-5.14±0.27		-4.28±0.18
2	4030.76	-0.44	YF	12	-6.22	26	21	-5.34	15	-4.49
	4033.07	-0.58	YF	...	...	18	13	-5.48	...	...
	4034.49	-0.76	YF	5	-6.34	13	10	-5.44	8	-4.50
5	4041.36	+0.41	YF	8	-6.08	19	18	-5.16	15	-4.35
	4055.54	+0.08	YF	...	...	8	7	-5.32	7	-4.40
	4018.11	-0.19	YF	...	...	8	8	-5.00	4	-4.40
	4035.73	-0.19	YF	...	...	9	10	-4.87	...	...
	4058.94	-0.30	YF	...	...	4	4	-5.19	4	-4.27
	4079.24	-0.53	KX	...	...	4	4	-4.98	6	-3.95
6	3806.72	0.00	YF	...	...	...	...	...	13	-4.00
	3823.51	-0.02	YF	...	...	8	8	-5.14	7	-4.29
	3823.89	-0.33	YF	...	...	3	2	-5.47	...	...
	3809.59	-0.45	YF	...	...	...	...	...	4	-4.12
23	4265.92	-0.42	YF	...	...	3	4	-4.68	...	...
28	4462.03	+0.11	YF	...	...	9	10	-4.70	...	...
Mn II				log Mn/H = -5.88±0.29				-5.11±0.26		-4.15±0.27
-	3701.40	-2.67	KX	...	...	...	...	...	24	-4.01
	3717.10	-2.42	KX	6	-5.50	...	...	...	...	...
	3724.81	-2.23	KX	...	...	...	...	...	21	-4.56
	3729.48	-1.87	KX	14	-5.62	...	...	...	42	-4.32
	3730.06	-2.47	KX	...	...	...	...	...	32	-3.96
	3743.39	-1.51	KX	...	...	...	...	...	72	-3.85
	3744.71	-2.99	KX	...	...	...	...	...	4	-4.00
	3764.86	-2.66	KX	...	...	7	8	-5.14	18	-4.34
	3775.05	-2.73	KX	...	...	...	...	...	5	-4.61
	3778.32	-0.86	KX	...	...	...	...	...	68	-4.50
	3789.51	-2.41	KX	...	...	8	10	-5.11	12	-4.67
	3800.24	-0.83	KX	...	...	5	6	-4.69	...	...
	3801.14	-2.41	KX	...	...	7	7	-5.29	...	...
	3803.88	-1.44	KX	...	...	...	...	...	7	-3.84
	3812.21	-1.90	KX	...	...	22	26	-5.00	...	...
	3812.52	-1.51	KX	...	...	5	6	-5.31	18	-4.47
	3817.26	-2.26	KX	...	...	6	7	-4.72	22	-3.80
	3839.05	-1.96	KX	...	...	...	...	...	27	-4.57
	3844.17	-1.38	KX	10	-6.24	41	49	-4.84	...	...
	3857.91	-3.81	KX	...	...	...	...	...	3	-3.98
	3859.21	-2.56	KX	...	...	...	...	...	13	-4.51
	3863.40	-2.12	KX	...	...	12	14	-5.25	...	...
	3879.00	-1.71	KX	...	...	20	24	-5.23	55	-4.02
	3897.62	-1.70	KX	...	...	17	20	-5.45	59	-3.99
	3898.07	-1.50	KX	...	...	...	...	...	50	-4.39
	3902.38	-2.71	KX	...	...	6	7	-4.93	15	-4.19
	3917.32	-1.15	KX	...	...	17	20	-5.24	44	-4.29
	3926.11	-2.42	KX	...	...	...	...	...	23	-4.02
	3930.97	-2.15	KX	...	...	6	7	-5.01	22	-4.08
	3941.22	-2.62	KX	4	-5.49	13	15	-4.68	35	-3.74
	3943.60	-2.24	KX	...	...	9	11	-4.96	26	-4.12
	3952.42	-1.50	KX	...	...	...	...	...	25	-4.09
	3953.59	-2.27	KX	...	...	...	...	...	5	-4.21
	3975.74	-1.36	KX	...	...	...	...	...	21	-4.35
	3986.58	-2.60	KX	...	...	4	5	-5.25	22	-3.66
	3994.12	-1.18	KX	...	...	4	5	-5.37	14	-4.61
	3995.31	-2.44	KX	...	...	6	7	-5.29	12	-4.67
	4000.04	-1.21	KX	...	...	12	14	-4.98	40	-3.95
	4081.45	-2.24	KX	...	...	15	18	-4.62	...	...
	4083.66	-4.82	KX	...	...	...	...	...	19	-3.71
	4085.40	-2.26	KX	...	...	...	...	...	31	-4.16
	4087.90	-2.91	KX	...	...	2	2	-5.41	13	-4.16
	4094.40	-2.58	KX	...	...	3	4	-5.42	12	-4.53
	4105.00	-1.35	KX	...	...	...	...	...	36	-4.67
	4110.62	-1.51	KX	...	...	12	14	-5.48	38	-4.45
	4140.44	-2.45	KX	...	...	10	12	-4.91	28	-4.05
	4171.04	-2.36	KX	...	...	...	...	...	28	-3.88
	4171.51	-2.11	KX	...	...	8	10	-5.04	29	-4.08

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Table 5 – *continued*

				ν Cnc		ι CrB(primary)			HR 8349	
						observed	inferred			
Mult.	λ(Å)	log gf	Ref.	W_λ(mÅ)	log N/H	W_λ(mÅ)	W_λ(mÅ)	log N/H	W_λ(mÅ)	log N/H
Mn II (continued)										
-	4174.32	-3.55	KX	...	...	22	25	-5.31	...	...
	4184.47	-1.95	KX	...	...	...	...	...	32	-4.15
	4200.28	-1.74	KX	...	...	13	15	-5.19	42	-4.10
	4205.40	-3.38	KX	...	...	28	31	-5.31	57	-4.10
	4206.37	-1.57	KX	12	-6.01	44	51	-4.67	...	...
	4207.23	-4.47	KX	...	...	...	...	...	13	-4.26
	4232.84	-2.26	KX	...	...	...	...	...	15	-3.64
	4237.87	-2.96	KX	...	...	5	6	-4.85	18	-3.93
	4238.80	-3.63	KX	...	...	25	29	-5.11	44	-4.22
	4239.19	-2.25	KX	...	...	15	18	-4.97	47	-3.82
	4240.39	-2.07	KX	...	...	11	13	-4.94	42	-3.76
	4242.92	-2.99	KX	...	...	6	7	-4.75	25	-3.68
	4244.24	-2.40	KX	...	...	14	17	-4.86	46	-3.70
	4251.74	-1.06	KX	14	-6.02	28	32	-5.32	68	-3.99
	4252.96	-1.59	KX	15	-5.86	33	38	-5.02	...	...
	4253.12	-2.09	KX	...	...	10	12	-4.96	...	...
	4259.20	-1.59	KX	12	-5.99	42	49	-4.71	...	...
	4275.87	-1.92	KX	...	...	...	...	...	14	-4.02
	4281.69	-0.87	KX	...	...	...	...	...	9	-4.04
	4281.94	-2.55	KX	...	...	12	14	-4.83	...	...
	4282.47	-1.68	KX	...	...	33	38	-4.87	...	...
	4283.77	-2.20	KX	...	...	20	24	-4.84	...	...
	4284.43	-2.26	KX	...	...	13	15	-5.07	49	-3.75
	4288.07	-2.76	KX	...	...	8	10	-4.80	30	-3.77
	4289.60	-3.31	KX	...	...	3	4	-4.69	16	-3.64
	4292.25	-2.23	KX	9	-5.51	...	..	...	...	...
	4293.26	-0.42	KX	...	...	...	...	...	15	-4.20
	4293.68	-0.53	KX	...	...	...	...	...	11	-4.27
	4308.16	-1.72	KX	...	...	16	18	-5.48	61	-3.91
	4310.70	-0.16	KX	...	...	...	...	...	20	-4.27
	4311.23	-0.68	KX	...	...	...	...	...	5	-4.51
	4317.71	-1.92	KX	...	...	4	5	-5.21	25	-4.04
	4318.52	-2.52	KX	...	...	4	5	-5.36	21	-4.25
	4326.63	-1.25	KX	16	-6.17	44	51	-4.98	...	...
	4343.98	-1.09	KX	...	...	...	...	...	83	-3.91
	4345.59	-2.16	KX	...	...	...	...	...	29	-4.39
	4346.41	-1.54	KX	...	...	...	...	...	24	-4.62
	4348.39	-1.50	KX	...	...	...	...	...	64	-4.06
	4356.62	-2.03	KX	...	...	10	12	-5.40	44	-4.11
	4363.25	-1.91	KX	...	...	11	13	-5.40	42	-4.21
	4365.22	-1.35	KX	...	...	13	15	-5.37	43	-4.27
	4371.89	-3.02	KX	...	...	...	...	...	7	-4.28
	4377.74	-2.14	KX	...	...	7	8	-5.49	28	-4.41
	4379.61	-1.85	KX	...	...	10	12	-5.57	...	...
	4385.75	-3.03	KX	...	...	...	...	...	6	-4.40
	4391.96	-2.89	KX	...	...	...	...	...	7	-4.45
	4393.38	-2.32	KX	...	...	6	7	-5.36	26	-4.27
	4403.50	-1.80	KX	...	...	6	7	-5.33	26	-4.28
	4441.99	-2.35	KX	...	...	4	5	-5.49	21	-4.39
	4478.64	-0.95	KX	7	-6.24	22	25	-5.40	54	-4.30
	4497.95	-2.99	KX	...	...	3	4	-5.00	16	-3.95
	4500.55	-2.07	KX	...	...	5	6	-5.42	23	-4.36
	4503.20	-2.16	KX	...	...	5	6	-5.33	...	...
	4509.22	-3.60	KX	...	...	2	2	-4.71	6	-3.86
	4510.21	-0.72	KX	...	...	...	...	...	8	-4.23
	4518.96	-1.33	KX	...	...	12	14	-5.39	40	-4.33
	4519.24	-2.57	KX	...	...	4	5	-5.31	16	-4.37
	4525.34	-2.07	KX	...	...	11	13	-5.02	44	-3.78
	4530.03	-0.64	KX	...	...	2	2	-5.09	...	...
	4610.59	-2.37	KX	...	...	2	2	-4.93	5	-4.25
	4639.14	-0.68	KX	...	...	...	...	...	8	-4.21

				ν Cnc		ι CrB(secondary)			HR 8349	
						observed	inferred			
Mult.	λ(Å)	log gf	Ref.	W_λ(mÅ)	log N/H	W_λ(mÅ)	W_λ(mÅ)	log N/H	W_λ(mÅ)	log N/H
Fe I				log Fe/H = -4.44±0.23				-4.41±0.25		-4.65±0.22
2	4427.31	-2.91	KX	...	...	3	19	-4.23	...	...
4	3859.91	-0.71	MF	40	-4.67	...	...	...	4	-4.74
	3899.71	-1.53	MF	8	-4.88	12	50	-4.70	...	...
	3824.44	-1.36	MF	25	-4.44	18	56	-4.88	...	...
	3856.37	-1.29	MF	15	-4.81	23	81	-4.53	...	...
	3895.66	-1.67	MF	...	...	8	25	-4.87	...	...
	3922.91	-1.65	MF	14	-4.49	16	69	-4.49	...	...

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Table 5 – *continued*

				ν Cnc		ι CrB (secondary) observed		ι CrB (secondary) inferred		HR 8349	
Mult.	λ(Å)	log gf	Ref.	W_λ(mÅ)	log N/H	W_λ(mÅ)	W_λ(mÅ)	log N/H	W_λ(mÅ)	log N/H
Fe I (continued)										
4	3930.30	-1.59	MF	30	-4.03	...	...	...	...	...
	3927.96	-1.59	MF	18	-4.38	20	94	-4.04	...	...
	3920.26	-1.75	MF	12	-4.43	13	56	-4.57	...	...
20	3820.43	+0.12	MF	55	-4.51	56	119	-4.44	9	-4.78
	3825.88	-0.04	MF	46	-4.63	...	...	...	8	-4.65
	3840.44	-0.51	MF	25	-4.75	...	...	...	...	...
	3849.97	-0.87	MF	22	-4.45	21	75	-4.38	...	...
	3878.02	-0.91	MF	20	-4.50	19	69	-4.47	...	...
	3872.50	-0.93	MF	19	-4.50	19	69	-4.54	...	...
	3917.18	-2.16	MF	4	-4.08	...	...	...	...	...
21	3758.24	-0.03	MF	...	...	...	...	...	6	-4.78
	3727.62	-0.66	MF	21	-4.74	...	...	...	...	...
	3795.00	-0.76	MF	15	-4.80	...	...	...	...	...
	3787.88	-0.86	MF	21	-4.49	16	44	-4.90	...	...
22	3786.68	-2.22	MF	...	...	4	25	-3.96	...	...
	3812.96	-1.27	KX	17	-4.24	13	56	-4.38	...	...
	3790.09	-1.76	MF	5	-4.36	5	25	-4.37	...	...
	3850.82	-1.73	MF	6	-4.31	5	25	-4.54	...	...
41	4383.54	+0.20	MF	42	-4.72	48	113	-4.58	5	-4.86
	4404.75	-0.14	MF	36	-4.50	35	100	-4.51	7	-4.33
	4415.12	-0.62	MF	22	-4.40	20	75	-4.50	...	...
42	4271.76	-0.16	MF	38	-4.47	37	106	-4.39	...	...
	4325.76	-0.01	MF	42	-4.43	34	75	-4.92	6	-4.51
	4202.03	-0.71	MF	17	-4.52	18	69	-4.59	...	...
	4250.79	-0.71	MF	20	-4.39	18	69	-4.55	3	-4.16
43	4045.82	+0.28	MF	...	...	...	...	...	7	-4.77
	4063.59	+0.07	MF	43	-4.50	...	...	...	...	...
	4071.74	-0.02	MF	34	-4.64	40	113	-4.20	...	...
	4005.25	-0.61	MF	22	-4.42	23	94	-4.08	...	...
	4143.87	-0.45	MF	26	-4.46	24	81	-4.59	...	...
	4132.06	-0.65	MF	17	-4.51	21	88	-4.16	...	...
45	3815.84	+0.30	MF	41	-4.81	...	...	...	6	-4.86
	3827.82	+0.06	MF	37	-4.64	...	...	...	5	-4.67
	3841.05	-0.05	MF	30	-4.70	...	...	...	...	...
	3902.95	-0.47	MF	23	-4.52	25	88	-4.11	...	...
	3966.06	-1.64	MF	...	...	4	19	-4.07	...	...
68	4528.62	-0.82	MF	...	...	11	50	-4.39	...	...
	4459.12	-1.28	MF	...	...	6	31	-4.24	...	...
	4482.26	-1.65	KX	...	...	3	19	-4.14	...	...
	4447.22	-1.34	MF	...	...	4	19	-4.44	...	...
71	4282.40	-0.81	MF	12	-4.24	...	...	...	...	...
	4315.08	-0.97	MF	...	...	6	25	-4.63	...	...
	4352.74	-1.26	MF	...	...	3	13	-4.52	...	...
72	3977.74	-1.08	MF	4	-4.49	...	...	...	...	...
	3949.94	-1.20	MF	...	...	4	19	-4.53	...	...
	4009.71	-1.20	MF	7	-4.09	3	13	-4.74	...	...
152	4260.47	-0.02	MF	28	-4.38	...	...	...	...	...
	4235.94	-0.34	MF	13	-4.52	10	50	-4.70	...	...
	4222.22	-0.97	MF	5	-4.36	5	19	-4.66	...	...
	4210.35	-0.87	MF	...	...	7	31	-4.46	...	...
	4198.31	-0.72	MF	15	-4.08	13	63	-4.12	...	...
	4191.44	-0.73	MF	16	-3.98	11	56	-4.16	...	...
	4299.24	-0.52	MF	10	-4.54	13	50	-4.51	...	...
	4271.16	-0.35	MF	12	-4.54	15	56	-4.57	...	...
	4250.12	-0.40	MF	15	-4.36	16	69	-4.30	...	...
	4233.61	-0.60	MF	9	-4.42	10	44	-4.50	...	...
175	3859.21	-0.68	MF	5	-4.66	...	...	...	...	...
	3873.76	-0.79	MF	...	...	5	19	-4.75	...	...
217	4067.28	-1.42	MF	...	...	3	13	-4.31	...	...
276	3998.05	-0.84	MF	...	...	7	38	-4.19	...	...
278	3956.68	-0.55	MF	9	-4.32	11	50	-4.10	...	...
	3997.39	-0.39	MF	5	-4.78	11	44	-4.51	...	...
	4021.87	-0.66	MF	5	-4.49	5	19	-4.76	...	...
	3981.77	-1.08	MF	6	-4.00	...	...	...	...	...
280	3897.90	-0.38	KX	...	...	7	19	-4.80	...	...
	3863.74	-1.36	MF	...	...	4	25	-3.90	...	...
284	3910.84	-1.59	MF	...	...	2	13	-3.98	...	...
350	4466.55	-0.59	MF	6	-4.45	7	31	-4.54	...	...
	4476.02	-0.73	KX	7	-4.23	...	...	...	...	...
	4443.20	-1.02	MF	...	...	4	19	-4.37	...	...
352	4245.60	-1.70	MF	...	...	2	13	-3.87	...	...
354	4156.80	-0.62	MF	...	...	5	19	-4.77	...	...
355	4203.99	-1.08	KX	...	...	4	19	-4.31	...	...
357	4134.68	-0.49	MF	8	-4.40	7	25	-4.73	...	...
	4127.61	-0.99	MF	5	-4.11	...	...	...	...	...

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Table 5 – *continued*

				ν Cnc		ι CrB(secondary) observed			HR 8349	
Mult.	λ(Å)	log gf	Ref.	W_λ(mÅ)	log N/H	W_λ(mÅ)	W_λ(mÅ) inferred	log N/H	W_λ(mÅ)	log N/H
Fe I	(continued)									
357	4132.90	-0.92	MF	...	...	5	25	-4.29	...	...
	4114.45	-1.22	MF	...	...	3	13	-4.20	...	...
	4109.80	-0.91	MF	...	...	4	19	-4.12	...	...
359	4062.45	-0.78	MF	...	...	5	25	-4.43	...	...
	4079.85	-1.33	MF	...	...	3	19	-4.00	...	...
364	3925.65	-1.10	KX	...	...	6	31	-3.98	...	...
	3918.42	-1.01	KX	...	...	3	13	-4.52	...	...
	3942.44	-0.98	MF	...	...	4	19	-4.37	...	...
	3925.95	-1.17	KX	5	-3.94	4	19	-4.17	...	...
385	3744.10	-0.64	MF	...	...	4	13	-4.40	...	...
414	4309.38	-1.18	MF	...	...	3	13	-4.32	...	...
429	3781.75	-0.78	MF	...	...	8	44	-3.92	...	...
430	3893.39	-0.48	MF	...	...	4	13	-4.30	...	...
	3918.64	-0.74	KX	...	...	5	25	-4.34	...	...
	3944.89	-1.46	MF	...	...	2	13	-3.98	...	...
488	3867.22	-0.42	MF	7	-4.42	8	31	-4.50	...	...
522	4199.10	+0.25	MF	20	-4.51	...	...	...	...	...
523	4143.42	-0.47	KX	13	-4.04	...	...	...	...	...
528	3843.26	-0.14	MF	...	...	7	19	-4.77	...	...
529	3839.26	-0.25	MF	8	-4.51	...	...	...	...	...
558	4073.76	-0.92	MF	...	...	4	19	-4.18	...	...
559	4067.98	-0.43	MF	4	-4.57	...	...	...	...	...
	4085.31	-0.71	MF	8	-3.95	...	...	...	...	...
560	4024.74	-0.97	KX	...	...	5	25	-4.01	...	...
562	3948.10	-0.26	KX	3	-4.86	6	19	-4.83	...	...
	3957.03	-0.59	MF	...	...	4	19	-4.42	...	...
	3955.35	-1.01	MF	...	...	3	13	-4.21	...	...
565	3928.08	-0.77	KX	...	...	4	19	-4.36	...	...
604	3956.46	-0.26	MF	7	-4.46	6	19	-4.77	...	...
	3948.78	-0.34	MF	11	-4.14	10	50	-4.09	...	...
606	3916.73	-0.52	MF	5	-4.36	...	...	...	...	...
607	3824.31	-0.12	KX	...	...	10	38	-4.40	...	...
608	3821.18	+0.30	MF	14	-4.64	...	...	...	...	...
	3805.34	+0.37	MF	12	-4.78	...	...	...	...	...
655	4031.97	-1.06	MF	...	...	3	19	-4.05	...	...
661	3951.16	-0.38	MF	5	-4.49	7	31	-4.39	...	...
664	3846.80	+0.10	MF	8	-4.66	10	31	-4.62	...	...
689	4224.18	-0.41	MF	10	-4.07	7	31	-4.38	...	...
693	4227.43	+0.26	KX	...	...	20	75	-4.32	...	...
	4247.43	-0.23	MF	4	-4.70	9	38	-4.43	...	...
	4225.45	-0.50	MF	...	...	4	19	-4.53	...	...
	4217.55	-0.51	MF	4	-4.38	4	19	-4.52	...	...
	4196.22	-0.74	MF	5	-4.07	...	...	...	...	...
694	4154.81	-0.37	MF	...	...	6	25	-4.54	...	...
695	4153.91	-0.27	MF	4	-4.64	6	25	-4.62	...	...
	4157.79	-0.56	KX	...	...	5	25	-4.33	...	...
	4158.79	-0.67	MF	5	-4.12	4	19	-4.35	...	...
698	4084.50	-0.59	MF	3	-4.49	8	44	-3.89	...	...
726	4137.00	-0.54	MF	11	-3.87	...	...	...	...	...
800	4219.36	+0.12	MF	9	-4.54	10	38	-4.65	...	...
801	4118.55	+0.28	MF	16	-4.39	16	63	-4.21	...	...
802	4014.53	-0.20	MF	...	...	7	31	-4.46	...	...
804	3846.41	-0.43	MF	...	...	4	19	-4.29	...	...
806	3916.73	-0.52	MF	...	...	7	31	-4.30	...	...
830	4388.41	-0.59	MF	6	-4.02	3	13	-4.52	...	...
	4469.38	-0.26	MF	...	...	6	25	-4.49	...	...

				ν Cnc		ι CrB(primary) observed			HR 8349	
Mult.	λ(Å)	log gf	Ref.	W_λ(mÅ)	log N/H	W_λ(mÅ)	W_λ(mÅ) inferred	log N/H	W_λ(mÅ)	log N/H
Fe II				log Fe/H = -4.60±0.20				-4.44±0.22		-4.46±0.20
3	3981.62	-4.84	KX	...	...	6	5	-4.40	...	...
	3938.29	-3.89	MF	32	-4.47	33	29	-4.37	16	-4.44
	3945.21	-4.19	MF	20	-4.51	18	14	-4.54	8	-4.51
	3914.48	-4.05	MF	24	-4.54	22	18	-4.55	8	-4.66
14	3783.35	-3.16	KX	37	-4.74	34	30	-4.77	24	-4.65
	3821.92	-3.82	KX	19	-4.56	18	15	-4.54	8	-4.57
21	4119.53	-4.90	KX	...	...	16	4	-4.03	...	...
	4075.95	-4.65	KX	...	...	6	6	-4.09	...	...
22	4124.79	-4.20	MF	...	...	10	8	-4.40	5	-4.33
	4070.03	-5.05	KX	...	...	3	4	-3.88	...	...

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Table 5 – *continued*

				ν Cnc		ι CrB(primary) observed	ι CrB(primary) inferred		HR 8349	
Mult.	λ(Å)	log gf	Ref.	W_λ(mÅ)	log N/H	W_λ(mÅ)	W_λ(mÅ)	log N/H	W_λ(mÅ)	log N/H
Fe II (continued)										
23	3779.58	-3.74	KX	10	-4.89	11	8	-4.86	7	-4.62
	3833.01	-4.32	KX	...	...	6	6	-4.37	...	...
	3896.10	-3.98	KX	...	...	6	5	-4.80	...	...
26	4580.06	-3.65	KX	16	-4.70	...	...	...	7	-4.71
	4584.00	-4.32	KX	...	...	5	4	-4.53	...	...
	4461.44	-4.20	KX	...	...	7	5	-4.61	...	...
27	4351.76	-2.21	MF	58	-4.87	56	50	-4.92	56	-4.54
	4416.82	-2.60	MF	46	-4.76	53	46	-4.62	42	-4.51
	4173.45	-2.65	MF	...	...	73	69	-3.95	...	...
	4303.17	-2.55	MF	52	-4.72	58	51	-4.55	52	-4.32
	4385.38	-2.57	MF	45	-4.86	54	48	-4.59	...	...
	4128.74	-3.77	MF	22	-4.39	25	24	-4.18	13	-4.27
	4273.32	-3.34	MF	40	-4.26	30	25	-4.51	20	-4.40
28	4296.57	-3.01	MF	52	-4.25	44	39	-4.44	39	-4.21
	4369.40	-3.67	MF	19	-4.48	19	17	-4.40	12	-4.32
	4122.64	-3.38	MF	34	-4.44	36	33	-4.31	23	-4.32
	4258.16	-3.40	MF	...	...	23	18	-4.68	18	-4.40
	4087.27	-4.71	MF	...	...	3	2	-4.52	...	...
29	3824.91	-3.41	MF	28	-4.57	25	21	-4.63	...	...
	3872.76	-3.22	KX	19	-4.97	22	17	-4.89	12	-4.80
	3974.16	-3.51	MF	...	...	12	12	-4.80	7	-4.79
	4002.08	-3.37	KX	17	-4.85	19	13	-4.86	8	-4.83
32	4384.33	-3.50	MF	26	-4.50	22	18	-4.60	12	-4.55
	4314.29	-3.60	KX	28	-4.34	...	...	...	...	...
	4278.16	-3.83	KX	18	-4.40	...	...	...	10	-4.18
	4413.60	-3.87	MF	11	-4.64	7	7	-4.73	5	-4.60
37	4629.34	-2.37	MF	50	-4.88	60	52	-4.64	39	-4.80
	4555.89	-2.45	MF	47	-4.89	61	55	-4.46	50	-4.40
	4515.34	-2.48	MF	47	-4.85	56	49	-4.61	44	-4.52
	4491.40	-2.77	MF	41	-4.71	48	42	-4.51	36	-4.45
	4520.22	-2.60	MF	43	-4.86	54	48	-4.53	39	-4.57
	4489.18	-2.97	MF	42	-4.50	44	39	-4.42	29	-4.45
	4472.92	-3.43	MF	18	-4.71	22	18	-4.57	10	-4.63
	4582.84	-3.26	MF	27	-4.61	34	30	-4.38	20	-4.41
	4534.17	-3.47	MF	24	-4.48	28	25	-4.30	16	-4.33
38	4583.83	-1.80	MF	...	...	78	69	-4.69	62	-4.72
	4549.47	-2.14	MF	...	...	69	61	-4.59	...	...
	4522.63	-2.25	MF	56	-4.83	69	62	-4.44	53	-4.52
	4508.28	-2.21	MF	51	-5.00	64	56	-4.67	45	-4.78
	4620.51	-3.28	MF	22	-4.74	...	...	...	15	-4.57
	4576.33	-3.04	MF	32	-4.69	43	38	-4.37	26	-4.46
	4541.52	-3.05	MF	33	-4.65	40	35	-4.44	27	-4.41
39	4138.40	-4.48	KX	...	...	7	7	-4.04	...	...
43	4601.38	-4.40	KX	...	...	3	2	-4.67	...	...
126	4046.81	-4.09	KX	...	...	3	4	-3.87	...	...
	4032.95	-2.83	KX	...	...	24	24	-4.15	...	...
127	3845.18	-2.26	KX	24	-4.83	...	...	...	18	-4.72
	3863.96	-2.33	KX	12	-5.06	...	...	...	8	-4.97
	4024.55	-2.48	MF	...	...	33	31	-4.29	23	-4.34
130	3781.51	-2.75	KX	9	-4.92	...	...	...	6	-4.80
141	4147.27	-3.64	KX	...	...	5	5	-4.15	...	...
150	4138.21	-3.22	KX	...	...	5	5	-4.52	...	...
151	4031.44	-3.14	KX	10	-4.34	9	10	-4.13	4	-4.49
152	3863.41	-2.55	KX	7	-5.12	...	...	...	...	...
	3863.96	-2.33	KX	...	...	17	13	-4.93	...	...
153	3827.08	-2.64	MF	22	-4.39	25	26	-4.17	17	-4.26
	3814.12	-2.41	MF	21	-4.64	35	36	-4.10	28	-4.15
154	3759.46	-2.16	MF	36	-4.42	31	32	-4.47	14	-4.85
	3755.56	-2.43	KX	9	-5.12	12	12	-4.87	8	-4.77
171	4474.19	-3.07	KX	...	...	4	4	-4.34	3	-4.31
172	4048.83	-2.09	KX	...	...	23	21	-4.45	...	...
	4044.01	-2.36	KX	13	-4.55	12	13	-4.09	12	-4.36
	4041.64	-3.11	KX	...	...	5	5	-4.23	...	...
	4051.21	-3.11	KX	...	...	5	5	-4.23	...	...
173	3935.94	-1.86	MF	...	...	41	42	-4.04	28	-4.32
	3906.04	-1.83	MF	33	-4.42	34	35	-4.29	26	-4.41
186	4635.33	-1.65	MF	29	-4.47	35	35	-4.23	26	-4.39
	4549.21	-1.87	MF	16	-4.70	31	31	-4.15	26	-4.20
	4625.91	-2.20	KX	9	-4.65	8	5	-4.89	7	-4.58
187	4446.24	-2.58	KX	5	-4.59	8	7	-4.38	...	...
188	4111.88	-2.29	KX	4	-5.02	8	8	-4.63	4	-4.79
	4069.88	-2.80	KX	...	...	5	5	-4.37	5	-4.20
189	4061.78	-2.15	KX	6	-4.97	...	...	...	4	-4.93
190	3938.97	-1.85	MF	27	-4.41	29	29	-4.28	22	-4.36
	3996.34	-2.91	KX	...	...	6	6	-4.15	...	...

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Table 5 – *continued*

					ν Cnc		ι CrB(primary) observed	ι CrB(primary) inferred		HR 8349	
Mult.	λ(Å)	log gf	Ref.	W_λ(mÅ)	log N/H	W_λ(mÅ)	W_λ(mÅ)	log N/H	W_λ(mÅ)	log N/H
Fe II (continued)										
191	3975.03	-2.02	KX	7	-5.03	...	...	...	...	...
	3918.53	-2.14	KX	...	...	16	15	-4.46	6	-4.78
192	3762.89	-1.54	KX	19	-4.96	21	20	-4.87	16	-4.85
201	4444.56	-2.49	KX	...	...	...	...	...	8	-4.13
212	3960.90	-1.41	KX	8	-4.92	11	12	-4.67	9	-4.71
	4057.46	-1.66	KX	15	-4.31	17	18	-4.28	...	...
213	4354.34	-1.74	KX	5	-4.59	...	...	...	...	...
	4507.13	-1.87	KX	6	-4.30	3	2	-4.81	4	-4.39
219	4628.82	-1.60	KX	...	...	5	5	-4.60	...	...
	4631.87	-1.82	KX	...	...	3	2	-4.80	3	-4.53
	4625.55	-2.03	KX	...	...	4	5	-4.16	...	...
220	4313.03	-1.66	KX	...	...	8	8	-4.36	...	...
	4318.22	-1.93	KX	...	...	5	6	-4.20	...	...
	4321.34	-1.76	KX	...	...	5	6	-4.38	...	...
	4319.68	-1.69	KX	...	...	6	6	-4.45	...	...
222	4493.53	-1.44	KX	...	...	...	...	...	6	-4.57
	4449.66	-1.60	KX	4	-4.70	8	8	-4.35	5	-4.49
	4431.63	-1.93	KX	...	...	6	7	-4.08	5	-4.15
-	3844.79	-0.92	KX	...	...	6	7	-4.64	...	...
	3894.64	-1.82	KX	...	...	3	4	-4.68	...	...
	3898.62	-1.66	KX	...	...	11	13	-4.25	6	-4.53
	3903.76	-1.51	KX	...	...	14	15	-4.32	11	-4.39
	3908.07	-1.25	KX	...	...	5	6	-4.34	4	-4.45
	3911.58	-2.54	KX	...	...	...	...	...	3	-3.97
	3922.04	-1.07	KX	4	-4.73	6	6	-4.53	5	-4.54
	3924.80	-1.14	KX	...	...	5	6	-4.20	...	...
	3926.69	-2.34	KX	...	...	4	5	-4.06	...	...
	4016.37	-1.55	KX	...	...	...	...	...	3	-4.18
	4202.52	-2.33	KX	8	-4.21	4	4	-4.51	4	-4.37
	4213.52	-2.24	KX	...	...	...	...	...	4	-4.04
	4263.90	-1.64	KX	10	-4.33	9	10	-4.32	7	-4.41
	4286.28	-1.61	KX	...	...	11	12	-4.24	10	-4.24
	4319.38	-2.11	KX	...	...	3	4	-4.23	...	...
	4357.58	-2.14	KX	15	-4.40	16	17	-4.31	12	-4.38
	4361.25	-2.08	KX	...	...	11	11	-4.56	5	-4.81
	4384.08	-2.46	KX	...	...	5	5	-4.55	...	...
	4402.88	-2.75	KX	...	...	10	11	-3.89	...	...
	4418.96	-1.97	KX	...	...	5	6	-4.12	4	-4.22
	4451.54	-1.82	KX	20	-4.50	25	25	-4.29	21	-4.30
	4455.26	-1.99	KX	14	-4.51	16	14	-4.46	13	-4.38
	4461.71	-2.03	KX	...	...	...	...	...	13	-4.34
	4480.69	-2.34	KX	...	...	...	...	...	6	-4.42
	4487.15	-2.12	KX	...	...	4	5	-4.17	...	...
	4499.71	-1.76	KX	5	-4.54	5	5	-4.53	...	...
	4512.06	-2.13	KX	...	...	2	2	-4.59	...	...
	4556.39	-2.13	KX	...	...	3	4	-4.27	...	...
	4579.52	-2.36	KX	10	-4.32	11	12	-4.18	9	-4.20
	4596.02	-1.82	KX	18	-4.51	21	20	-4.40	15	-4.46
	4638.05	-1.47	KX	10	-4.44	10	10	-4.44	8	-4.48
	4640.84	-1.81	KX	4	-4.57	9	10	-4.11	3	-4.61
Fe III			log Fe/H =	...				-4.32		-4.23±0.18
4	4419.59	-2.22	KX	...	...	5	6	-4.32	10	-4.39
	4382.51	-3.02	KX	...	...	...	...	...	4	-4.13
	4431.02	-2.57	KX	...	...	...	...	...	6	-4.35
	4393.76	-2.59	KX	...	...	...	...	...	10	-4.02
Co I			log Co/H =	-6.23				-4.10		...
16	4020.90	-2.07	CS	...	...	4	5	-4.10	...	...
31	3995.31	-0.22	CS	4	-6.23	...	...	...	...	...
Ni I			log Ni/H =	-5.58				...		...
32	3858.30	-0.97	FM	9	-5.63	...	...	...	...	...
86	4401.54	+0.40	KX	4	-5.52	...	...	...	...	...
Ni II			log Ni/H =	-5.62±0.10				-5.90±0.46		-6.11±0.19
9	4362.10	-2.72	KX	14	-5.54	7	7	-5.85	5	-5.89
	4244.80	-3.11	KX	5	-5.69	3	2	-6.05	...	...
10	4192.07	-3.05	KX	8	-5.52	4	4	-5.80	...	...
11	4067.05	-1.83	KX	40	-5.61	21	17	-6.27	15	-6.23
	3849.58	-1.88	KX	33	-5.77	15	12	-6.43	12	-6.30
12	4015.48	-2.42	KX	22	-5.57	13	12	-5.89	7	-6.04

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Table 5 – *continued*

					ν Cnc		ι CrB(primary) observed		ι CrB(primary) inferred		HR 8349	
Mult.	λ(Å)	log gf	Ref.	W_λ(mÅ)	log N/H		W_λ(mÅ)		W_λ(mÅ)	log N/H	W_λ(mÅ)	log N/H
Sr II				log Sr/H =	-8.01±0.23					-7.20±0.07		-7.88
1	4077.71	+0.15	WM	59	-8.13		77		71	-7.14	31	-8.09
	4215.52	-0.17	WM	52	-8.15		68		62	-7.19	34	-7.67
3	4305.45	-0.11	WM	19	-7.74		...		...	...	...	...
	4161.80	-0.47	WM	...	...		.12		13	-7.27	...	...
Y II				log Y/H =	-7.76±0.19					-7.41±0.21		-7.17±0.21
1	4204.69	-1.76	HL	13	-7.70		6		7	-7.47	5	-6.86
5	4309.62	-0.75	HL	34	-7.87		23		25	-7.62	16	-7.17
	4398.02	-1.00	HL	30	-7.79		19		21	-7.53	12	-7.11
	4422.59	-1.27	HL	...	...		...		...	...	10	-6.96
	4235.73	-1.50	HL	17	-7.72		8		10	-7.48	6	-6.98
	4358.73	-1.32	HL	20	-7.81		12		14	-7.49	4	-7.36
6	3982.59	-0.49	HL	37	-8.01		32		36	-7.50	22	-7.24
	3950.35	-0.49	HL	41	-7.85		36		39	-7.39	26	-7.13
7	3774.33	+0.21	HL	...	...		...		...	...	34	-7.54
	3788.70	-0.70	HL	49	-7.89		41		44	-7.58	38	-7.14
	3832.95	-0.34	HL	40	-7.99		...		...	...	16	-7.57
	3818.34	-0.98	HL	28	-7.82		20		23	-7.45	13	-7.08
	3878.28	-1.49	HL	20	-7.56		10		12	-7.34	4	-7.15
8	3776.56	-0.81	HL	29	-7.95		18		20	-7.72	...	...
	3747.55	-0.91	HL	...	...		16		19	-7.67	8	-7.42
13	4374.94	+0.16	HL	...	...		50		52	-7.37	40	-7.17
14	4124.91	-1.50	HL	...	...		11		13	-7.18	7	-6.77
16	3930.66	-1.61	HL	17	-7.42		...		...	...	...	...
	3951.59	-1.98	HL	11	-7.31		4		6	-7.10	...	...
61	3800.86	-0.13	PN	...	...		9		11	-6.98	...	...
	3872.11	-0.29	PN	...	...		7		8	-6.95	...	...
	3782.27	+0.55	PN	...	...		...		...	...	6	-7.23
72	3845.05	+0.09	PN	...	...		4		5	-7.38	...	...
81	4465.27	+0.20	PN	6	-7.71		3		4	-7.53	...	...
Zr II				log Zr/H =	-7.60±0.09					-7.52±0.13		-7.33±0.14
15	4211.88	-0.98	GB	26	-7.62		12		13	-7.63	8	-7.14
	4258.05	-1.13	BG	...	...		8		10	-7.62	...	...
16	3958.24	-0.26	GB	42	-7.70		...		...	...	15	-7.51
	3998.98	-0.67	GB	39	-7.43		26		30	-7.29	15	-7.08
17	3915.94	-0.77	BG	31	-7.62		18		20	-7.55	9	-7.28
18	3817.59	-0.86	BG	28	-7.63		...		...	...	4	-7.59
29	4090.52	-1.10	GB	21	-7.53		9		11	-7.48	4	-7.25
	4156.24	-0.71	GB	30	-7.64		17		19	-7.56	8	-7.32
30	3991.14	-0.30	GB	40	-7.62		28		31	-7.52	16	-7.33
	4045.63	-0.80	GB	...	...		18		20	-7.43	4	-7.57
40	4317.32	-1.38	GB	11	-7.70		4		5	-7.64	...	...
	4496.96	-0.81	GB	24	-7.77		...		...	...	...	...
41	4149.22	-0.03	GB	47	-7.61		35		38	-7.52	24	-7.30
	4208.99	-0.46	GB	...	...		...		...	...	11	-7.41
42	4034.10	-1.55	BG	10	-7.51		4		5	-7.40	...	...
	4161.20	-0.58	GB	41	-7.38		21		24	-7.52	13	-7.19
43	4050.32	-1.00	BG	24	-7.55		10		12	-7.55	4	-7.37
	3934.80	-0.83	BG	27	-7.61		11		12	-7.71	5	-7.43
44	3782.24	-1.18	GB	14	-7.66		7		8	-7.33	...	...
54	4071.09	-1.60	BG	6	-7.61		...		...	...	...	...
	4024.45	-1.04	GB	...	...		13		15	-7.23	...	...
67	4613.95	-1.52	BG	7	-7.65		2		2	-7.79	...	...
79	4359.74	-0.56	GB	28	-7.58		17		20	-7.41	9	-7.17
	4370.96	-0.71	GB	23	-7.61		10		12	-7.59	5	-7.33
	4403.35	-1.12	GB	...	...		6		6	-7.56	...	...
	4414.54	-1.07	GB	12	-7.66		5		6	-7.58	...	...
	4440.54	-1.19	GB	15	-7.43		6		7	-7.40	...	...
88	4379.78	-0.35	GB	32	-7.48		17		14	-7.49	...	...
	4442.99	-0.33	GB	26	-7.73		14		15	-7.69	7	-7.41
Ba II				log Ba/H =	≤-6.97					≤-8.42		...
1	4554.03	+0.16	WM	65	≤-6.97		24		23	≤-8.42	...	...
La II				log La/H =	...					-9.19		...
40	3988.52	+0.32	MC	...	...		3		2	-9.19	...	...

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Table 5 – *continued*

				ν Cnc		ι CrB(primary) observed			HR 8349 inferred	
Mult.	λ(Å)	log gf	Ref.	Wλ(mÅ)	log N/H	Wλ(mÅ)	Wλ(mÅ)	log N/H	Wλ(mÅ)	log N/H
Gd II			log Gd/H = -9.29					-8.69±0.22		-7.95±0.14
2	3768.39	+0.45	MC	9	-9.24	...	...	...	...	...
	3850.69	0.00	MC	...	...	2	2	-9.01	...	...
	3852.45	+0.09	MC	4	-9.34	4	5	-8.51	6	-7.85
	3850.97	+0.15	MC	...	...	5	6	-8.63	4	-8.13
20	3916.51	+0.17	MC	...	...	...	...	...	3	-8.00
	4049.86	+0.41	MC	...	...	3	4	-8.63	5	-7.83
Pt II			log Pt/H =	...				-8.37:±0.91		-7.80:
-	3806.91	-1.00	AS	...	...	2	2	-9.93	...	...
	4034.17	-1.00	AS	...	...	5	6	-8.01	...	...
	4061.66	-1.00	AS	...	...	3	4	-8.11	...	...
	4148.30	-1.00	AS	...	...	3	4	-7.89	...	...
	4288.40	-1.00	AS	...	...	3	4	-8.91	...	...
	4514.17	-1.00	AS	...	...	12	14	-7.37	6	-7.80
Hg I			log Hg/H =	...				-6.02		-5.67
1	4358.34	-0.47	WM	...	...	5	6	-6.02	5	-5.67
Hg II			log Hg/H = -7.82					-6.01		-5.30
-	3983.96	-1.73	DW	32	-7.82	70	83	-6.01	156	-5.30

Notes: § = one-half weight. Sources of gf-values: AS = assumed; BG = Biemont *et al.* (1981); CS = Cardon *et al.* (1982); DW = Dworetsky (1980b); FM = Fuhr *et al.* (1981); GB = Grevesse *et al.* (1981); HL = Hannaford *et al.* (1982); KX = Kurucz (1989, in preparation); LA = Lanz & Artu (1985); MC = Magazzu & Cowley (1986); MF = Martin, Fuhr & Wiese (1988) for Sc through Mn; Fuhr, Martin & Wiese (1988) for Fe through Ni; PN = Pitts & Newson (1986); SC = Schaeffer (1971); WF = Wiese & Fuhr (1975); WM = Wiese & Martin (1980); WS = Wiese, Smith & Glennon (1966); Wiese, Smith & Miles (1969); YF = Younger *et al.* (1978).

and secondary of ι CrB an estimate of the line's equivalent width in the corresponding uncontaminated stellar spectrum is given in addition to the observed equivalent width. These estimates are, of course, model dependent. Table 6 contains an analysis of the Mg I and Cr I lines for ι CrB (secondary).

Table 6. Additional abundances from metallic lines for ι CrB secondary.

				observed	inferred	
Mult.	λ(Å)	log gf	Ref.	Wλ(mÅ)	Wλ(mÅ)	log N/H
Mg I (log Mg/H = -4.88)						
14	4351.91	-0.52	WS	7	25	-4.88
15	4167.27	-0.81	SC	6	25	-4.88
Cr I (log Cr/H = -6.32±0.18)						
1	4254.35	-0.11	YF	12	62	-6.20
	4274.80	-0.23	YF	8	38	-6.47
	4289.72	-0.36	YF	6	31	-6.46
38	3963.90	+0.67	YF	3	12	-6.13

Note: Sources of gf-values given at end of Table 5.

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4 Discussion

The average abundance values of the program stars are compared with those of the Sun (Grevesse 1984) in Table 7. Table 8 compares the results of this paper with those of previous analyses. The values for ν Cnc of Adelman *et al.* (1984) were revised by Adelman & Fuhr (1985). The new values show a mean reduction in metallicity of 0.22 ± 0.16 dex despite a substantial reduction in the microturbulence. For the most part this is due to the smaller equivalent widths.

For ι CrB, some of the major differences compared with Ross & Aller (1970) and Kodaira & Takada (1978) are a result of equivalent width and gf-value differences as well as the previous analyses being done for a single star and this paper's consideration of the effects of the companion. The comparison with the results of HR 8349 by Guthrie (1984) shows that some abundances agree quite well, but others do not. This is similar to what has occurred with previous comparisons.

The abundances of this paper's HgMn stars are shown with the previous series results for HgMn stars in Table 9. HR 8349 is the only star in which O II lines have been identified and is

Table 7. Stellar and solar abundances.

	ν Cnc			ι CrB(primary)			HR 8349			Sun
Species	log N/H	n	[N/H]	log N/H	n	[N/H]	log N/H	n	[N/H]	log N/H
He I	-1.57	2	-0.57	-1.82	3	-0.82	-1.72	3	-0.72	(-1.00)
C II	-3.88	2	-0.57	-4.01±0.17	4	-0.70	-3.54±0.28	3	-0.23	-3.31
O II	...	...	...	...	...	...	-2.59±0.23	3	+0.50	-3.09
Mg I	-4.66	2	-0.24	...	...	...	-5.27	2	-0.85	-4.42
Mg II	-4.71±0.08	7	-0.29	-4.84±0.12	4	-0.42	-4.94±0.11	6	-0.52	-4.42
Al I	-6.38	2	-0.85	...	...	...	-6.29	1	-0.76	-5.53
Si I	-4.78	1	-0.33	...	...	...	...	...	...	-4.45
Si II	-4.59±0.24	5	-0.14	-4.51±0.19	5	-0.06	-4.16±0.11	5	+0.29	-4.45
Si III	...	...	...	...	...	...	-4.26±0.05	3	+0.19	-4.45
P II	...	...	...	-5.69±0.07	4	+0.86	-4.65±0.15	10	+1.90	-6.55
P III	...	...	...	...	...	...	-4.88±0.12	3	+1.67	-6.55
S II	-5.05±0.11	3	-0.26	-4.79±0.26	9	0.00	-5.08±0.18	9	-0.29	-4.79
Ca I	-6.21	1	-0.67	...	...	...	...	...	...	-5.54
Ca II	-6.06	1	-0.52	-5.07	1	+0.47	-4.95	1	+0.59	-5.54
Sc II	-8.19±0.18	10	+0.71	...	...	...	-7.67±0.10	6	+1.23	-8.90
Ti II	-6.38±0.24	65	+0.60	-6.72±0.23	46	+0.26	-6.86±0.21	26	+0.12	-6.98
V II	-8.20	2	-0.20	-7.56±0.19	13	+0.44	...	...	...	-8.00
Cr I	-5.73±0.06	3	+0.60	...	...	...	...	...	...	-6.33
Cr II	-5.88±0.21	40	+0.45	-6.01±0.22	43	+0.32	-6.11±0.23	22	+0.22	-6.33
Mn I	-6.21±0.13	3	+0.34	-5.14±0.27	14	+1.41	-4.28±0.18	10	+2.27	-6.55
Mn II	-5.88±0.29	11	+0.67	-5.11±0.26	68	+1.44	-4.15±0.27	89	+2.40	-6.55
Fe I	-4.44±0.23	84	-0.11	...	...	...	-4.65±0.22	11	-0.32	-4.33
Fe II	-4.60±0.20	74	-0.27	-4.44±0.22	117	-0.11	-4.46±0.20	88	-0.13	-4.33
Fe III	...	...	...	-4.32	1	+0.01	-4.22±0.18	4	+0.11	-4.33
Co I	-6.23	1	+0.85	-4.10	1	+2.98	...	...	...	-7.08
Ni I	-5.58	2	+0.17	...	...	...	...	...	...	-5.75
Ni II	-5.62±0.10	6	+0.13	-5.90±0.46	1	-0.15	-6.11±0.19	4	-0.36	-5.75
Sr II	-8.01±0.23	3	+1.09	-7.20±0.07	3	+1.90	-7.88	2	+1.22	-9.10
Y II	-7.76±0.19	15	+2.00	-7.41±0.21	19	+2.35	-7.17±0.21	17	+2.79	-9.76
Zr II	-7.60±0.19	24	+1.84	-7.52±0.13	24	+1.92	-7.33±0.14	17	+2.11	-9.44
Ba II	≤-6.97	1	≤+2.90	<-8.42	1	≤+1.45	...	...	...	-9.87
La II	...	...	...	-9.15	1	+1.72	...	...	...	-10.87
Gd II	-9.29	2	+1.59	-8.69±0.22	4	+2.19	-7.95±0.14	4	+2.93	-10.88
Pt II	...	...	...	-8.38:±0.91	6	+1.82	-7.80:	1	+2.40	-10.2
Hg I	...	...	...	-6.02	1	+4.81	-5.67	1	+5.15	(-10.83)
Hg II	-7.82	1	+3.01	-6.01	1	+4.82	-5.30	1	+5.53	(-10.83)

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Table 8. Comparison of log N/H values with previous analyses.

	ν Cnc			ι CrB (primary)		
Species	Adelman & Fuhr	This Paper	Species	Ross & Aller	Kodaira & Takada	This Paper
He I	-1.40	-1.57	C II	-3.44	-2.51	-4.01
C II	-3.30	-3.88	Mg I	-4.57	...	...
Mg I	-4.34	-4.66	Mg II	-4.67	...	-4.84
Mg II	-4.50	-4.69	Si II	-4.48	-5.09	-4.51
Si II	-4.60	-4.62	S II	-4.82	...	-4.79
Ca II	-6.39	-6.42	Ca II	-6.15	-5.55	-5.07
Sc II	-7.94	-8.24	Ti II	-7.31	-7.08	-6.72
Ti II	-6.33	-6.45	V II	-8.20	...	-7.56
V II	-8.00	-8.21	Cr I	-6.15	...	...
Cr I	-5.34	-5.74	Cr II	-6.42	-6.43	-6.01
Cr II	-5.35	-5.69	Mn I	-6.00	-5.75	-5.14
Mn I	-5.99	-6.22	Mn II	-5.90	-5.87	-5.11
Mn II	-6.40	-6.59	Fe I	-5.17	-4.66	...
Fe I	-4.14	-4.44	Fe II	-5.25	-4.61	-4.44
Fe II	-4.33	-4.57	Ni I	-6.00	...	...
Ni II	-6.30	-6.54	Ni II	-7.40	...	-5.90
Sr II	-7.96	-8.26	Sr II	-7.80	-7.11	-7.20
Y II	-7.77	-7.80	Y II	-7.50	-7.55:	-7.41
Zr II	-7.61	-7.63	Zr II	-8.50	-7.49	-7.52
Ba II	-7.70	≤-7.58	Ba II	-9.10	-7.86	≤-8.42
Hg II	-7.82	-8.22				
ξ (km s^{-1})	2.3	0.1		2.5	...	0.2

HR 8349

Species	Guthrie	This Paper
Mg	-5.1	-4.94
P	-4.9	-4.65
Sc	-7.2	-7.67
Ti	-6.8:	-6.86
Cr	-5.8	-6.11
Mn	-4.6	-4.15
Fe	-4.5	-4.46
Y	-7.3:	-7.17

only the third HgMn star to show Al I lines. It is the most silicon, calcium, manganese and mercury rich star. Its phosphorous abundance is similar to that of κ Cnc and its scandium abundance to ϕ Her. It is only one of a few HgMn stars to possibly show weak singly ionized rare earth lines, the others being ι CrB (primary) and ν Cnc.

The derived abundances for ι CrB (primary) and ν Cnc for the most part agree with the run of abundances seen in other stars of this class. But the former star is only one of a few with V II and Pt II lines as well as possibly a Co I line. This star requires more study to better estimate both the primary and secondary star abundances. The later star is the most nearly helium, magnesium, manganese and nickel normal, yet at the same time is the most calcium poor. Its helium abundance indicates in some sense that diffusion processes have changed its photospheric abundances the least (see Charbonneau & Michaud 1988).

The abundances of only three elements were derived for ι CrB (secondary). The value of log Fe/H = −4.41 from Fe I lines is nearly solar as is log Cr/H = −6.32 from Cr I lines. But its value of log Mg/H from Mg I lines is −0.46 dex less than solar. With a microturbulence of 2.1 km s^{-1} close to what is expected for a $T_{\rm eff}$ = 9250 K star, nothing particularly peculiar is now known about this star. But it still merits further study especially as it might serve as a local standard of normalcy for its primary.

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Table 9. Comparison of abundances.

Species	κ Cnc log N/H	HR 8349 log N/H	HR 7664 log N/H	μ Lep log N/H	53 Tau log N/H	φ Her log N/H	ι CrB(p) log N/H	28 Her log N/H	ν Cnc log N/H	Sun log N/H
He I	-2.26	-1.72	-2.10	-1.89	-1.80	-1.62	-1.82	-2.00	-1.57	(-1.00)
C II	-3.97	-3.54	-3.88	-3.80	-3.95	-3.58	-4.01	-3.95	-3.88	-3.31
O II	...	-2.59	...	...	...	...	...	...	...	-3.09
Mg I	-5.17	-5.27	...	-4.87	...	-5.28	...	-4.54:	-4.66	-4.42
Mg II	-5.17	-4.94	-5.75	-4.77	-4.94	-4.80	-4.84	-5.15	-4.71	-4.42
Al I	...	-6.29	...	...	...	...	...	...	-6.38	-5.53
Si I	...	...	...	...	...	...	...	...	-4.78	-4.45
Si II	-4.48	-4.16	-4.48	-4.33	-4.65	-4.64	-4.51	-4.80	-4.59	-4.45
Si III	-4.47	-4.26	-4.80	-4.46	-4.59	...	...	...	...	-4.45
P II	-4.73	-4.65	-4.99	-5.48	...	...	-5.69	-5.72	...	-6.55
P III	-4.77	-4.88	...	...	...	...	...	...	...	-6.55
S II	-5.56	-5.08	-5.48	-4.81	-5.34	-4.91	-4.79	-4.61	-5.05	-4.79
Ca I	...	...	...	...	-5.34	-5.20	...	-6.19	-6.21	-5.54
Ca II	-5.67	-4.95	-5.55	-5.24	-5.02	-5.36	-5.07	-5.64	-6.06	-5.54
Sc II	-8.37	-7.67	-9.14	-8.50	-9.54	-7.47	...	...	-8.19	-8.90
Ti II	-6.82	-6.86	-6.20	-6.45	-5.76	-6.37	-6.72	-6.97	-6.38	-6.98
V II	-7.60	...	...	<-6.95	...	...	-7.56	...	-8.20	-8.00
Cr I	...	...	...	...	-5.80	-5.18	...	-5.96	-5.73	-6.33
Cr II	-6.42	-6.11	-6.70	-6.03	-5.89	-5.50	-6.01	-6.28	-5.88	-6.33
Mn I	-4.39	-4.28	...	-4.40	-4.45	-4.92	-5.14	-5.69	-6.21	-6.55
Mn II	-4.45	-4.16	-5.42	-4.50	-4.68	-5.08	-5.11	-5.61	-5.88	-6.55
Fe I	-4.49	-4.65	-3.96	-4.70	-5.28	-4.35	...	-4.48	-4.44	-4.33
Fe II	-4.57	-4.46	-3.97	-4.75	-5.24	-4.59	-4.44	-4.51	-4.60	-4.33
Fe III	-4.44	-4.22	-4.04	-4.87	-4.65	-4.64	-4.32	-4.37	...	-4.33
Co I	...	...	...	...	...	...	-4.10	...	-6.23	-7.08
Ni I	...	...	...	...	...	...	...	...	-5.58	-5.75
Ni II	-6.18	-6.11	-6.15	-6.42	-6.49	-6.26	-5.90	...	-5.62	-5.75
Ga II	-4.75	...	-6.14	-4.50:	-6.41	-6.00	...	...	...	...
Sr II	-8.54	-7.88	-8.75	-7.34	-8.17	-8.34	-7.20	-6.75	-8.01	-9.10
Y II	-8.33	-7.17	-8.21	-7.20	-8.20	-6.72	-7.41	-6.82	-7.76	-9.76
Zr II	...	-7.33	...	<-8.35	-7.49	-7.32	-7.52	-8.66	-7.60	-9.44
Xe II	-5.60	...	...	...	...	...	...	...	...	(-9.81)
Ba II	...	...	...	...	<-9.55	<-8.06	<-8.42	<-9.93	<-6.97	-9.87
La II	...	...	...	...	...	...	-9.15	...	...	-10.87
Gd II	...	-7.95	...	...	...	...	-8.69	...	-9.29	-10.88
Pt II	...	-7.80:	...	...	...	...	-8.38:	-7.77:	...	-10.2
Hg I	...	...	...	-5.72	...	-6.33	-6.02	...	...	(-10.83)
Hg II	-5.98	-5.67	-7.40	-5.73	...	-6.38	-6.01	-7.89	-7.82	(-10.83)
Teff	13125	12975	12875	12500	12000	11325	11250	10750	10375	
log g	3.59	3.90	3.51	3.62	4.21	3.79	3.75	3.76	3.59	

All nine HgMn stars in Table 9 have derived abundances of He I, C II, Mg II, Si II, S II, Ca II, Ti II, Cr II, Mn II, Fe II, Sr II and Y II. Linear correlation coefficients (r) were calculated between pairs of these values and with the effective temperature and log g. The correlation (or anticorrelation) is regarded as significant if there is less than one chance in 20 that this value will occur by chance. For nine items, the absolute value of r has to be greater than 0.666. Table 10 lists those correlations found to be significant. The derived abundances from He I, Mg II and Cr II lines correlate with one another as do the derived abundances from Si II and Mn II lines and the effective temperature. The derived abundances from S II lines correlate with those of from Sr II and Y II lines and those from Mn II lines with those from Ca II lines. The

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Table 10. Definite correlations.

Compared	Values	r
He I	Mg II	0.715
He I	Cr II	0.832
Mg II	Cr II	0.853
Si II	Mn II	0.687
Si II	T_{eff}	0.692
Mn II	T_{eff}	0.769
S II	Sr II	0.877
S II	Y II	0.879
Ca II	Mn II	0.694
Fe II	log g	-0.725

derived abundances from Fe II lines anticorrelate with the derived values of the surface gravity. Figs 1–4 show the correlations of log Cr/H versus log He/H, log Mn/H versus effective temperature, log Sr/H versus log S/H and log Fe/H versus log *g*, respectively.

Many of the correlations of Table 10 were previously found using the values of six HgMn stars (Paper V). While the Ca and Ti abundances were previously found to be correlated, but

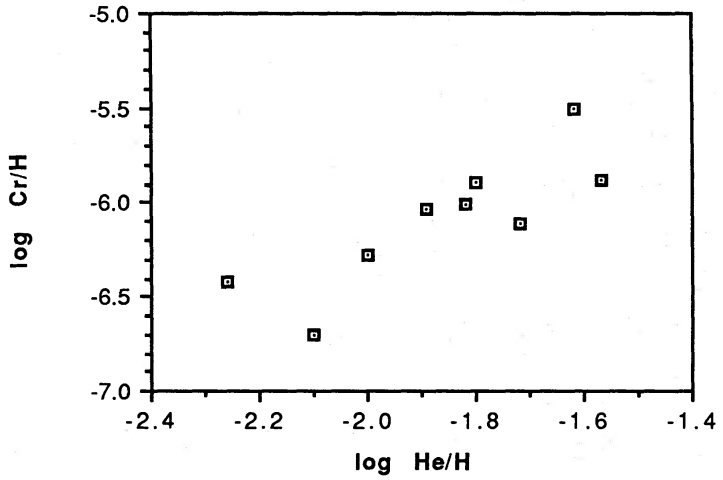

Figure 1. The derived abundances from Cr II lines versus those from He I lines in nine HgMn stars.

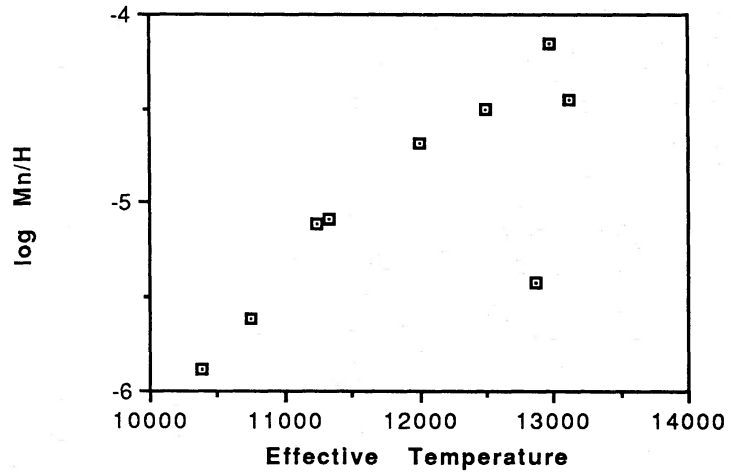

Figure 2. The derived abundances from Mn II lines versus the effective temperature for nine HgMn stars.

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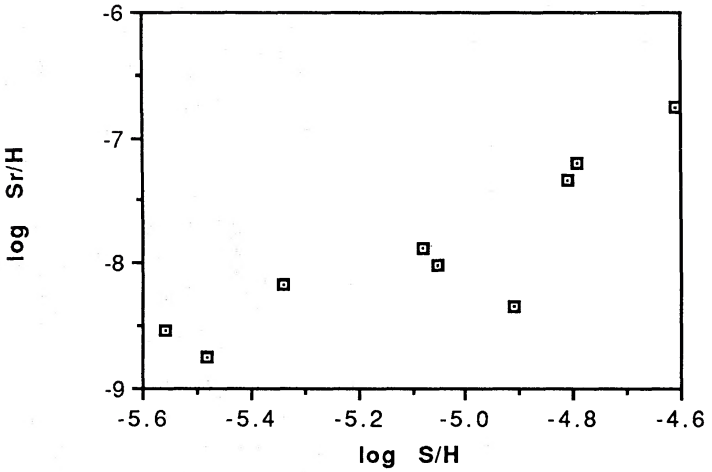

Figure 3. The derived abundances from Sr II lines versus those from S II lines in nine HgMn stars.

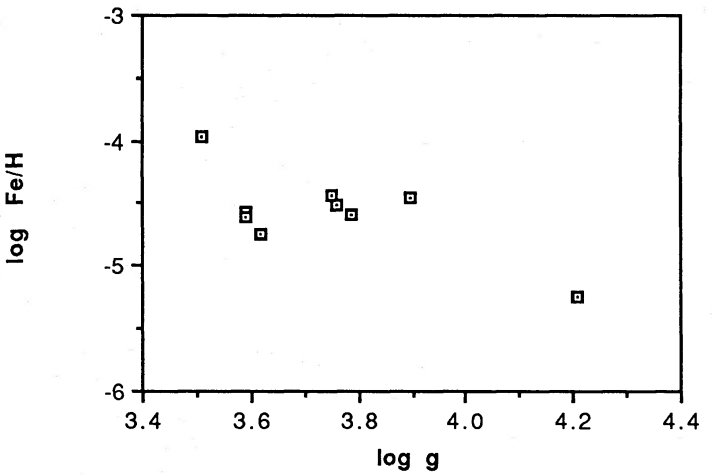

Figure 4. The derived abundances from Fe II lines versus the surface gravity for nine HgMn stars.

here they are not. The temperature dependences exhibited by the Si II and Mn II lines are signals of radiative diffusion effects. The value for HR 7664 definitely falls off the log Mn/H versus effective temperature correlation of the other eight HgMn stars (Fig. 2). The anti-correlation of the iron abundance and the surface gravity is strongly influenced by 53 Tau (Fig. 4). None of the other correlations listed in Table 10 is so dependent on only one point.

It is desirable to formulate an index to describe the degree of peculiarity. To select items which are correlated with one another is desirable as they more likely represent underlying aspects of the HgMn phenomena rather than star-to-star differences. Elements whose abundances overlap the normal star range are also best avoided. Table 11 shows the results for the Population I stars of this series (except for τ Her) as well as of α Dra (Adelman *et al.* 1987) and the Sun when one averages the negative of the abundance anomalies (stellar value minus solar value) for He I and Si II lines and the abundance anomalies for the Mn II and Sr II lines. The HgMn stars have anomaly indices between 0.66 and 1.26 dex while the normal stars between 0.00 and 0.31 dex. So these groups are definitely separated. This way of examining the data confirms the impression that ν Cnc is the least anomalous HgMn star. Comparison of the derived abundances of ν Cnc with those of o Peg (Paper IV), the most peculiar 'normal' star, shows that although o Peg like ν Cnc exhibits overabundances of some elements in and

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Table 11. Abundance anomaly indices.

Star	Anomaly Index
μ Lep	1.26
28 Her	1.26
HR 8349	1.21
κ Cnc	1.17
ι CrB (p)	1.14
53 Tau	1.03
HR 7664	0.98
φ Her	0.81
ν Cnc	0.66
o Peg	0.31
θ Leo	0.23
α Dra	0.04
Sun	0.00

beyond the iron peak, it tends not to be as extreme and its pattern of anomalies is somewhat different. Further the derived abundances of light elements for o Peg tend to be nearer to solar than those of ν Cnc.

This simple anomaly index is sampling only four abundances. By not including the Sc II lines, for example, it does not measure the full peculiarity of ϕ Her. To formulate a better peculiarity index may well require including more elements and the use of upper limits for missing values.

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