DISCUSSION (Boyarchuk and Savanov)

PTITSYN: I wonder, do you not think that one can conclude from your diagrams that there is a correlation between elements which are produced in the same nuclear process, and vice versa?

BOYARCHUK: I have not looked at correlations with nuclear or diffusion processes. I am not sure the results are accurate enough to compare with some theory.

COWLEY: I can comment on this briefly, based on the material I have looked at, which is mainly that published by Myron Smith. The major correlations are between each element and its neighbour. There is a general trend for heavy elements to be enhanced and for light elements to be depleted. This general effect produces the correlation that Dr. Ptitsyn mentioned. Since nuclear processes build up nuclei from lighter ones to heavier ones, this kind of a correlation is to be expected.

PTITSYN: I agree, with the exception of the Zr-Ba correlation.

MICHAUD: Do you find a correlation [of abundance] with rotational velocity only for vanadium, or does it appear also for other elements?

BOYARCHUK: They are similar for the iron group, but I only made plots for a few elements.

HENSBERGE: I was surprised to see a good correlation between the relative La and Nd abundances. Cowley pointed out that, at least for cool magnetic Ap stars, the Nd lines in the visual are badly blended by Cr lines. Is this also the case in Am stars?

BOYARCHUK: The data we presented is based on published analyses. I would have to have examined the spectra myself in order to answer your question.

COWLEY: I believe it is probably not affected by the Cr, because Cr is not extremely overabundant the way it is in some of the magnetic stars.

DROBYSHEVSKI: One should be cautious when interpreting anti-correlations between chemical anomalies and rotational velocities in Am stars. These correlations favour only two facts: the anomalies are concentrated in the outermost layers, and they must be continuously replenished. In this sense they agree with both the radiation pressure diffusion theory and the planetoidal hypothesis.

BURKHART: I am not convinced by the correlation between vanadium abundance and the rotational velocity of the star, because of the sin i factor in the figure. It appears to me that there are not enough points on the diagram, especially at large values of v sin i.

BOYARCHUK: On this diagram we have plotted log $\varepsilon(V)$ vs. v sin i. We think that the correlation is indicated by drawing an upper envelope over the points, because the scatter is due to the sin i factor. We realize that for any one star, the true rotational velocity can not be determined, but we think the sample is large enough to indicate that the correlation exists.

ADELMAN: May I make a plea to all observers to publish their equivalent widths and their Hγ profiles? This would permit one to intercompare the data of different observers for the same star.

Also, I want to mention something which seems to have been omitted. I am very interested in stars which lie between the coolest of the Hg-Mn

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stars and the hottest of the classical Am stars. It would be interesting to know whether or not the abundances have smooth trends between the two types.

DWORETSKY: I have comments as well. I agree with what Saul Adelman said about publishing all the equivalent widths and Hγ profiles; these should certainly be published. I only wish that we could persuade editors that this was a good idea. They usually want you to store these data in a vault someplace, or make them into a microfiche. The latter is at least a partially acceptable result, because they will exist, but they are then subject to accidental loss, etc. But, at least in principle, they are available.

There has been a lot of discussion of surface gravities of stars at this Colloquium. I would like to mention a paper in press [since published] by T. Moon and myself (MNRAS, 217, p. 305, 1985) concerning the calibration of the Strömgren c_0 and β indices in terms of T_{eff} and log g. We have checked E. G. Schmidt's theoretical β indices and the Relyea-Kurucz c_0 indices against eclipsing binaries of known gravity and Code's fundamental T_{eff} stars. We find that there is a discrepancy in log g of about 0.15-0.20, in the sense that the Kurucz profiles yield smaller gravities. We do not fully understand the reasons for this.

BOYARCHUK: The accuracy for determination of spectroscopic profiles is less than 0.15.

DWORETSKY: The precision with which any individual measurement can be made is quite good; that's not what I am talking about. There is a <u>systematic</u> deviation, and all the previous gravities are about 0.2 dex too small, on average. I wonder if anyone has a comment on that? We do not know the cause, but I am quite convinced that the discrepancy is real. It looks as if the Kurucz Balmer line profiles may somehow be at fault.

COWLEY: If we don't know the effective temperature of these objects to within, say 500°, I'm sure this affects the attempts to determine surface gravity by Hγ profile in some significant way. As you know, Lane and Lester suggest downward modifications of the order of 500° or even 900° for the Am stars, so surely this is a factor that should be considered.

DWORETSKY: It should be, but our method disagrees with the results of Lane and Lester. They found surface gravities which were very low for some stars, and we find that there is a strong correlation between the difference in gravity and the metallicity of the star as determined from the δm_1 index. The precise cause of the difference between Lane and Lester and ourselves is difficult to understand. It may have to do with the fact that they tried to fit the continuum in the visible and ultraviolet to model atmosphere fluxes, while we have looked at the Balmer jump and Hβ profile. We do find that Am stars in open clusters which should lie near the zero-age main sequence have a mean log g = 4.3 with our method. This is about the only evidence we have that our method is independent of the amount of line blanketing.

HUBENÝ: In spite of arguments against Kurucz's set of models or the LTE approach, there is at least one argument in favour of the

applicability of LTE. Dreiling and Bell calculated models for
Sirius and claimed that the spectroscopically and dynamically
determined gravities agree quite well. This suggests the problem
may lie in the treatment of opacities, or some error in the Kurucz
fluxes, because the model for Sirius was calculated using Bell's own
program.

DWORETSKY: It is interesting that Schmidt used other models also,
and calculated theoretical β indices for the older Kurucz,
Peytremann and Avrett models which used Griem theory. If we had
used those instead, there would have been no discrepancy between the
theory and the observed surface gravities. This is one reason that
we suspect that the broadening theory itself is at fault, because
the only large differences in predicted β's arose from the
differences in broadening theory and model atmospheres.

HUBENY: Unfortunately, Kurucz only stated that he used the Vidal,
Cooper and Smith theory, but that it was based on routines supplied
by Peterson. It is not easy to check these results; maybe there is
some error in the treatment of the atomic profile of the Balmer
lines.

DWORETSKY: I have no comment on that at all!

COWLEY: Are there any other comments? We still have a few
minutes.

DROBYSHEVSKI: When doing statistics among Am stars, one has to be
mindful of two groups of Am star binaries, the young and the
evolved. Otherwise, some important statistical correlation may be
lost.

ADELMAN: I have found good agreement between the observed Hγ
profiles in the line wings and shoulders for the predictions of VCS
theory as calculated using the ATLAS-compatible program BALMER for
normal B5 to A2 stars. I shudder to think what substantial errors
in the hydrogen lines would mean for the abundance analyses.

DWORETSKY: I shudder as well. I hesitate to come before you and
state that I have these doubts, but when the evidence is staring
you in the face, you must state what you think is going on, even if
it turns out to be wrong later. But, I think this is right!