HIGH RATE OF DESTRUCTION OF MOLECULAR CLOUDS BY HOT STARS

M. Heydari-Malayeri and M.C. Lortet
Observatoire de Paris, Meudon

L. Deharveng
Observatoire de Marseille

Tenorio-Tagle (1979) first proposed the idea of a third dynamical phase, the champagne phase, following the formation and expansion phases of an HII region; the idea was further explored by Bodenheimer et al. (1979) and Tenorio-Tagle et al. (1979). The champagne phase begins when the high pressure gas of an HII region formed inside a molecular cloud reaches the edge of the cloud and bursts into the lower pressure, low density, intercloud medium. One important implication of the model is the prediction of an enormous enhancement of the rate of erosion of the molecular cloud by the ionising radiation of hot stars, which begins as soon as the process of the decrease of the gas density between the star and the cloud is started. The proportion of hydrogen molecules eroded by ionising photons may reach about 10^{-2}. The mass eroded may exceed the mass of the ionised gas in the case where the ionisation front reaching the edge of the cloud is of D-type. Additional mechanisms (for instance stellar winds), if at work, may even increase the efficiency of the mechanism.

WELL STUDIED HII MOLECULAR COMPLEXES

The examples are very numerous. Disruption of the molecular cloud is found in some cases (for instance Sh2-125=IC 5146, Lada and Elmegreen 1979; Mon OB2, Blitz 1978). Let us focus our attention on molecular clouds containing groups of young objects in different stages of evolution. Four typical instances are K3-50 and the accompanying masers and radio sources (de Graauw et al. 1979); the group Sh2-152 and 153, and an H_2O maser west of Sh2-152 (Israel 1979); the nebulae Sh2-254 to 258 and associated masers and IR sources (Blair 1976); and the molecular cloud containing Sh2-247 and 252 (Baran 1977, Lada and Wooden 1979). In these groups and similar ones it is remarkable that the most diffuse regions (NGC 6857, Sh2-153, Sh2-254, and the diffuse part of Sh2-252) always coincide with the most eroded part of the CO complex or even with the absence of any CO. A more comprehensive analysis will be given by Deharveng (1979).

B. H. Andrew (ed.), Interstellar Molecules, 163–164.

THE CASE OF SHARPLESS 156

This nebula has been extensively studied by Heydari-Malayeri et al. (1980) and Heydari-Malayeri (1979). In this case the geometry is less favourable than for Sh2-252 or K3-50, where the CO cloud is seen edge on (see Colley and Scott (1977) and Wynn-Williams et al. (1977) for the geometry of K3-50), for the ionising star is seen projected on the bright core. From all available observations and some theoretical predictions on the ionisation structure by Stasinska (1978, 1979), we infer that the ionising star is now located outside the cavity it has eroded in the molecular cloud, so that its radiation reaches obliquely a large area of the surface of the molecular cloud. At this stage of evolution the star may have eroded about 10^3 $M_\odot$ of the molecular cloud.

CONCLUSIONS

A wide variety of objects seen in the same complex may have been formed at the same time, though local conditions (cloud density, mass of the star formed, and its depth in the cloud) have influenced the rapidity of their evolution. The idea of sequential star formation, therefore, would rather apply to large spatial scales, as demonstrated in the case of W3-W4 by Dickel (1979).

It will be very important in the future to obtain local densities and velocities, both for molecular and ionised gas.

REFERENCES

Baran, G.: 1977, private communication.
Blair, G.: 1976, Ph. D. Thesis.
Blitz, L.: 1978, Ph. D. Thesis, N.A.S.A. TM 79 708.
Bodenheimer, P., Tenorio-Tagle, G., Yorke, H.W.: 1979, Astrophys. J. 233, 479.
Colley, D., Scott, P.F.: 1977, M.N.R.A.S. 181, 703.
Deharveng, L.: 1979, Thesis, University of Marseille.
Dickel, H.R.: 1979, this Symposium.
de Graauw, T., Lidholm, S., Fitton, B., Israel, F.P., Sargent, A., Kuiper, T.B.H., Nieuwenhuyzen, H.: 1979, this Symposium.
Heydari-Malayeri, M.: 1979, Ph. D. Thesis, University of Paris VII.
Heydari-Malayeri, M., Testor, G., Lortet, M.C.: 1980 Astron. Astrophys. in press.
Israel, F.P.: 1979, private communication.
Lada, C.J., Elmegreen, B.G.: 1979, Astron. J. 84, 336.
Lada, C.J., Elmegreen, B.G.: 1978, Astrophys. J. (Letters) 226, L39.
Lada, C.J., Wooden, D.: 1979, Astrophys. J. 232, 158.
Stasinska, G.: 1978, Astron. Astrophys. 66, 257; Astron. Astrophys. Suppl. 32, 429.
Stasinska, G.: 1979, to be submitted to Astron. Astrophys.
Tenorio-Tagle, G.: 1978, Astron. Astrophys. 71, 59.
Tenorio-Tagle, G., Yorke, H.W., Bodenheimer, P.: 1979, Astron. Astrophys. 80, 110.
Wynn-Williams, C.G., Becklin, E.E., Mathews, K., Neugebauer, G., Werner, M.W.: 1977, M.N.R.A.S. 179, 255.