CONTAGIOUS B STAR FORMATION IN THE RHO OPHIUCHI DARK CLOUD

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Three young stars are still embedded in the small (0.7 pc wide) and densest region of the Rho Ophiuchi dark cloud. One of these stars coincides with the continuum source Oph 4 (Brown and Zuckerman, 1975). Their existence is indicated by the following: i) thermal continuum sources detected at 21 cm and 6 cm with the Westerbork Synthesis Radio-telescope (Netherlands) which display the presence of compact HII regions surrounding each of three stars; ii) peaks of CO emission ($J = 1 \rightarrow 0$ transition) detected with the MWO antenna of MacDonald (Texas) which are associated with asymmetrically shaped lines; iii) C 158α (and S 158α for Oph 4) line emission mapped with the Nancay Radiotelescope. All these observations imply that the three stars have B3 - B2 spectral types.

A possible interpretation of the simultaneous formation of three similar stars within a small area of the Rho Oph cloud is proposed, based on the contagious process of star formation described by Elmegreen and Lada (1977) for the case of OB associations. A group of nine background stars of types ranging between B2 and B9 (Chini et al., 1977) are thought to be associated with the cloud (Elias, 1978) but not embedded in it. These stars likely excite the evolved HII region detected at Westerbork (Falgarone et al., 1978) because their spectral types are consistent with the continuum flux of the HII region. The dense gas layer (called the cooled post-shock or CPS layer) that is compressed between the ionization front and its preceding shock front may become gravitationally unstable as it enters the densest parts of the cloud, thus leading to star formation. Such an instability is easily reached, as far as hot stars are concerned. The emergent fact is that, even if driven by a group of a few late B stars, the CPS layer can reach a Rayleigh-Taylor instability within $5\ 10^5$ to $5\ 10^6$ years, provided that the neutral parts of the adjacent cloud are dense enough ($n = 5\ 10^3 cm^{-3}$). The observed parameters, i.e. the size of the HII region, the Lyman continuum flux of the parent stars, and the penetration velocity of the CPS layer into the cloud, which is supplied by the CO self-reversed profiles (Encrenaz et al., 1975), are consistent with the current existence of gravitational instability. In the case of Rho Oph, the

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mass of the CPS layer, at the onset of instability, is between 10 $M_\odot$ and 70 $M_\odot$, a surprisingly low value.

Thus, the following main conclusions can be drawn:

1) if the contagious process is relevant, a group of a few B stars cannot induce the formation of stellar associations including several O stars;

2) on the other hand, the number of low mass stars formed through that mechamism is drastically constrained by the mass of the CPS layer, if the formation rate is supposed to reproduce the slope of the Initial Mass Function (Lequeux, 1979).

A strong selection effect appears if the hypothesis of the second conclusion is correct: if M_o is the typical stellar mass of an association, the later associations generated by the step-by-step process will exhibit stellar masses lying in a narrow interval around M_o.

In the case of Rho Ophiuchi, this effect seems to be supported by the fact that all the visible stars associated with the cloud are B stars or A0 stars, with the exception of one M1 star component of a double star.

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