rapid and they found no highly luminous phase. As an antidote to the disputes between the groups studying the collapse of spherically symmetrical protostars, L. Mestel (University of Manchester), surveying the role of rotation and magnetic fields in early stellar evolution, stressed that it is risky to assume that these factors are unimportant.

On one point all the theorists studying the collapse of spherically symmetrical condensations were agreed. The inside of a condensation collapses much more rapidly than the outside, giving the possibility that the interior can effectively form a star while the outside is still collapsing onto it. Several speakers, including Larson, thought this could lead to an interpretation of the infrared objects the properties of which were discussed by F. Low (University of Arizona). He said that several of these objects were probably protostars and that their spectrum could be understood as a combination of radiation from a central star, and stellar radiation degraded by absorption in a dusty cloud surrounding the star. Although he thought this to be qualitatively a satisfactory explanation, he stressed that the luminosity of some objects, combined with the observation that they had not changed significantly for a period of years, made them difficult to understand as ordinary theoreticians' protostars.

V. C. Reddish (Royal Observatory, Edinburgh) discussed observational evidence for the association of very young stars with dust clouds, and he linked this with the theory developed by Hoyle, Wickramasinghe and himself that the freezing of interstellar hydrogen onto cold dust grains could be the initial process in star formation. This theory was challenged by several speakers. M. Werner (University of Cambridge) doubted whether the grains would become cool enough and G. B. Field (University of California, Berkeley) doubted whether the hydrogen would freeze onto the grains.

GEOLOGICAL TIME

Short Polarity Intervals

from our Geomagnetism Correspondent

As more short geomagnetic polarity intervals are discovered, it becomes increasingly clear that the polarity time scale for the past four million years is not yet complete. When the main outline of this scale was first defined, it was found convenient to differentiate between "epochs" lasting about one million years and "events" lasting about 100,000 years. Each epoch and event was then given a name, with the result that the time scale appeared as a series of epochs some of which included one or more events. Subsequent discoveries have emphasized the arbitrariness of this scheme. It now seems that the frequency distribution of polarity intervals is continuous. An epoch containing an event is really a series of three independent intervals which differ only in length.

The original scheme was adopted because the main intervals were first defined from continental rocks dated by the potassium–argon method, which is usually incapable of resolving intervals much shorter than 100,000 years. Continuous ocean sediment cores and ocean magnetic anomalies later revealed the existence of shorter intervals. More recently, Cox (*J. Geophys. Res.*, **73**, 3247; 1968) predicted from a statistical model for field reversals that many zero to 50,000 year intervals remain undiscovered. One such interval, the reversed Blake event, was recently reported by Smith (J. D.) and Foster (*Science*, **163**, 565; 1969) who dated it in the Brunhes normal epoch at 108,000 to 114,000 years on the basis of sedimentation rates.

Because continental rocks are not continuous in time, the chances of detecting an interval of even a few tens of thousands of years on land are small. The only known example is the reversed Laschamp event defined in French Quaternary lava flows by Bonhommet and Babkine (*Compt. Rend. Acad. Sci.*, **264**, 92; 1967). Bonhommet and Zahringer (*Earth and Planet. Sci. Letters*, **6**, 47; 1969) have recently attempted to date this important event with surprising result. By sheer luck some of the flows contain only small quantities of excess radiogenic argon-40 whose presence is usually a serious problem in the potassium–argon dating of young volcanic rocks. The result is that Bonhommet and Zahringer have been able to set an upper limit of 20,000 years for the end of the Laschamp event. A lower limit for the end of the event is given by the 8,730 year carbon-14 age of overlying domitic projections. It is thus probable that the last reversal of the Earth's magnetic field took place as recently as 9,000 to 20,000 years ago. Furthermore, previously reported normally magnetized lavas from Reunion with potassium–argon ages of 40,000 years show that the maximum length of the Laschamp event could only have been 20,000 to 30,000 years.

Another interesting observation not offered by Bonhommet and Zahringer is that as more short polarity intervals are discovered, the average length of known polarity intervals goes down. This means that the statistical chance of a reversal following any given downswing of the dipole strength, such as the one occurring at present, may be higher than hitherto supposed.

GEOPHYSICS

Earthquakes and the Wobble

from a Correspondent

THE NATO Advanced Study Institute on Earthquake Displacement Fields and the Rotation of the Earth, held at the University of Western Ontario from June 22 to 29, attracted geophysicists and astronomers interested in the rotation of the Earth and the polar motion. Many of the contributions were prompted by the recent suggestion from D. E. Smylie (University of British Columbia) and L. Mansinha (University of Western Ontario) that large earthquakes excite the Chandler wobble and produce the observed changes in the secular pole.

At the meeting, Smylie and Mansinha described various aspects of the development of the statistical model of the earthquake excitation functions in order to show that earthquakes can excite the wobble to a value near the observed amplitude. They have examined polar coordinates and earthquake data recorded during the past decade, and were able to relate breaks in the pole path with the occurrence of earthquakes. Delegates were unable to explain the discrepancy between the results obtained from data supplied by the Bureau International de l'Heure,