scale of a nova than a flare. T Tauri stars are observed to change their luminosity in an erratic manner by 20 fold or more, but it is not certain whether this effect is due to variations in the optical depth of obscuring dust or to variations in the intrinsic output of the star.

Another possibility is that the Moon's surface was heated by solar wind particles, rather than by electromagnetic wave radiation. About half of the energy of a solar flare is normally emitted in the form of solar wind protons. If such a particle blast from a very large solar flare were to become magnetically trapped in the Earth's magnetopause tail, very high particle densities could become temporarily achieved. If then the Moon happened to be transiting through this energetic region, its surface could have become considerably scorched. Alternatively, it is also possible that both the Earth and Moon encountered a region of enhanced solar flare particle density, the remnant of a major prominence or "fireball" thrown out by the Sun [e.g., a coronal mass ejection]. In such a case the interplanetary magnetic field bound up with the particle blast wave could have acted as a magnetic bottle retarding the dispersal of this region of high particle density as it journeyed from the Sun.

Morgan, Laul, Ganapathy, and Anders (1971) have analyzed the glassy coating and crystalline interior of one lunar rock and find that the coating is enriched in a number or rare earth elements and alkali metals including Ir and Au. They conclude that the glass has been contaminated by a mixture of meteoric material with lunar soil. They suggest that the glassy material represents molten material splashed from a nearby meteoritic impact and that it was not produced by in situ melting due to radiative heating, as Gold has suggested.

However, the geochemical results reported by Morgan et al. could be interpreted differently. If at the time of radiative or solar wind heating the surface of the Moon had been covered by a fine deposit of micron and submicron-sized particles of cosmic dust, this material would have become fused into the underlying rock when melting occurred. This scenario is compatible with the proposal made earlier in this study (Chapter 3, Section 3.3.2) that the solar system was filled with unusually high concentrations of cosmic dust at the time of enhanced solar activity. In addition, the results of the glacial ice dust tests (Chapter 12) which indicate high cosmic dust deposition rates at the end of the Wisconsin ice age also support this interpretation.

The Lunar Record of Past Solar Flare Activity. Solar flare tracks left in the glassy surfaces of lunar micrometeorite craters provide a record of past solar flare activity. Assuming that the cratering rate has remained relatively constant for the past $2 \times 10^4$ years, Zook, Hartung, and Storzer (1977) conclude that solar flare activity must have been about 50 fold higher about 16,000 years ago. The activity curve which they have derived is shown in Figure 4.5. If the cratering rate was higher prior to 10,000 BP, as the GEH suggests, then the solar flare activity change presented in this diagram would be underestimated. The peak at 16,000 BP would then be expected to increase and shift to a more recent date. Thus this data would be compatible with the solar outburst date of ~12,700 years BP established on the basis of geological evidence; see Part III. It is significant that the conclusion reached by Zook et al. on the basis of lunar rock studies parallels that which I independently arrived at on the basis of the analysis of glacial ice dust and theoretical considerations regarding the response of the Sun to the accretion of elevated amounts of nebular material. Zook et al. (1977, p. 120) speculate that the elevated solar flare activity around 16,000 years BP may somehow have been associated with the retreat of the continental ice sheets at the end of the last glaciation, although they are not able to suggest a mechanism by which terrestrial temperature would correlate with solar flare activity. The GEH suggests such a mechanism, namely the influx of nebular material into the solar system could have caused terrestrial heating through an interplanetary hothouse effect and spectral shift effect, and also by activating the Sun as a result of material accretion; see Section 3.3.2 (**p. 90**) and Subsection 3.3.4 (**p. 102**).