THE PERMIAN-TRIASSIC SUPERNOVA IMPACT. C. H. Detre[1], I. Tóth[2], G. Don[1], Á. Z. Kiss[3], I. Uzonyi[3], P. Bodó[4], and Z. Schléder[4], [1]Geological Institute of Hungary, Stefánia út 14, H-1143 Budapest, Hungary, [2]Konkoly Observatory, P.O. Box 67, H-1525 Budapest, Hungary, [3]Institute for Nuclear Research, ATOMKI, P.O. Box 51, H-4001 Debrecen, Hungary, [4]Eötvös L. University, Department of Petrology and Geochemistry, Múzeum krt 4/a, H-1088 Budapest, Hungary.

The end of the Permian has been one of the most tranquil epochs of the Earth's history; from that time no powerful orogenic movements, no volcanism of considerable importance - save the effusion of the Siberian plateau-basalts - are known and also there are no traces of the impact of some bigger celestial body like a great meteorite, a core of a comet or some microplanet. The Permian-Triassic boundary as it is understood in traditional sense was the time of the renaissance of organic life. The crisis lasted approximately 20 million years during the Late Permian. The lasting „quiet and sneaking" character of the destructive process suggest the thought that the terrestrial and planctonic organisms may have been entirely defenseless against the increased level of the high-frequency electromagnetic and corpuscular radiations.

The characteristic phenomena of the Upper Permian are the enrichment of the ^{13}C isotope in a measure unprecedented in the Earth's entire history together with the fall of the amount of the oxygen in the atmosphere from 35% to 10-12% causing in this manner the „superanoxy at the end of the Permian" [1]. Both phenomena are known since some 20 years, and according to several opinions just these ones could have been the causes of extinction. If we change however the facts occupying in this connection the positions of the cause and effect : that is to say by interpreting the superanoxia as an effect of the decaying biomass, then more than sufficient explanation can be found for the observed reality. In brief : the rotting biomass extracts tremendous amounts of oxygen from the atmosphere and from the seas. The extinction of more than 90% of the species resulted inevitably in the accumulation of enormous amounts of dead biomass. The characteristic lithologies of the Upper Permian are worldwide sedimentary rocks having very high organic matter content : their organic components originate from the decaying biosphere. At the beginning of the Upper Permian the biosphere had suffered a kind of tremendous blow from the effects of which it could not recover even up to now : the available estimations - although their figures are broadly scattered - all conclude in pointing out that the amount of the recent biomass should be only a fraction of that existing 250 million years ago. The oxygen content of the recent atmosphere amounts to 21%; thus being far from that 35% which characterized it 250 million years ago. The bulk of coal measures sedimented during the Upper Carboniferous - Lower Permian is many times as voluminous as the productive biomass of the recent time. From the outset of the Triassic the formation of carbonate rocks is on a leap-like increase : the rate of their Post-Triassic accumulation is approximately by an order of magnitude higher as it has been before. It seems to be a satisfactory explanation for this development, that the amount of C consumed earlier by living organisms accumulated henceforth in the lithosphere.

The spherules of interstellar origin, which can be found in the Late Permian deposits provide a rather solid argument for seeing in them the interstellar dust swept together by the shock wave front of a supernova explosion. Having diameters between 3-20 μm, they are composed preponderantly of iron (in excess of 90%) containing also some percents of Ni, Ti and Si [2]. Their dimensions and elementary composition are remarkably similar in all occurrences. They were found in Hungary (in the Bükk Mountains), in Japan and South China, several occurrences of them are known in Central Asia, moreover in South Africa, Canada and the Antarctica too. These micron-sized particles which could have survived the penetration into the Earth's atmosphere became sedimented in the Upper Permian soil or on the sea-floor of that time. We have to mention here also the theory put forward by Ruderman and Truran some time ago [3]. According to them it should have been possible as well that the shock wave front of a nearby supernova explosion blew off a certain amount of dust from the Moon's surface : later these particles took part in the accumulation of geological deposits. In our case however we have to deal with spherules of interstellar origin. Based on the facts got known in this way and as an obvious explanation for their occurrence a nearby supernova explosion can be reconstructed. The spherules derived from the interstellar dust are additional evidences.

The event of the Upper Permian which during its course has dealt repeated but slow blows to the biosphere decimating but not exterminating it, moreover led to the sedimentation of the spherules may have been the result of the explosion of a supernova being then within 10 parsecs approximately from the Sun. The geological, paleontological and biostratigraphical evidences are all indicating that this explosion may have preceded the classical boundary between the Permian and the Triassic by some 20 million years.

References: [1] Detre Cs. H. et al. (1998) *LPS XXIX*, Abstract #1030. [2] Miono Sh. et al. (1998) *LPS XXIX*, Abstract #1029. [3] Ruderman, M. A. and Truran J. W. (1980) *Nature*, *284*, 328–329.