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Small bodies' impacts and tree-rings

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The Earth has no natural protection against cosmic bodies' impacts from space. It could be bombarded either by very small particles of cosmic dust every day or by huge bodies causing significant climatic changes. The AD 536 comet event is supposed to be the reason of the global temperature decrease of up to 3[U+F0B0]C (Baillie, The Holocene, 1994). Using the [U+F07E]7500 finish supra-long chronology analysis we also observed the tree growth stress after the AD 536 event.

The observation of small cosmic bodies by optical methods is most difficult as it was demonstrated in the case of the 2013 Chelyabinsk bolide. Though, there are proxy data providing detailed information about astronomical phenomena in the past. For example, the tree-ring analysis demonstrates the anomalous growth of trees after the Tunguska event in Siberia in 1908 and the same, but smaller effect after the Chulym bolide explosion in 1984 (Kasatkina, Shumilov, JETP Letters, 2007). We considered that the collisions with much smaller cosmic bodies sized from several to hundred meters may also cause similar effects.

The results of our dendrochronological research at the Kola Peninsula (northwestern Russia) showed the tree growth increase in 1873 (up to 30% compared to the previous year) at a large distance. The tree-ring growth was likely stimulated either by the comet substance spread over a large territory of the Kola Peninsula and introduced into the soil or by the NO produced during the Kola bolide impact. This fact confirms the evidence of the Kola bolide impact on February 4, 1873 described in "The earthquake catalogue of the Russian Empire" (Mushketov, Orlov, 1893).

We determined the distribution of the wind velocity in February 1873 using the Horizontal Neutral Wind Model 07 (HWM 07). The tree-ring analysis and the wind velocity distribution allowed us to estimate the possible trajectory of the Kola bolide flight in February 1873.

Our results showed that the dendrochronological method is proved to be the most efficient way to solve the main problems of paleoastrophysics connected with the asteroid and comet danger (cataloguing of events, estimating of the trajectory and action region, etc.)