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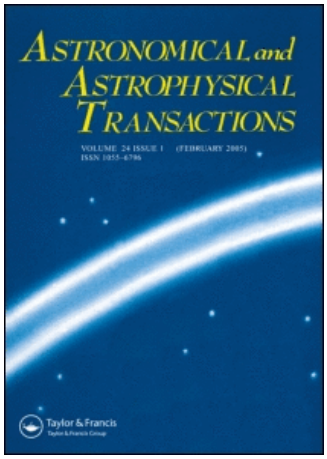

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AN INTERNATIONAL PROGRAM FOR STUDIES OF ECOLOGICAL CONSEQUENCES OF THE EARTH COLLISIONS WITH THE SOLAR SYSTEM SMALL BODIES (From the Point of View of the Tunguska Catastrophe of 1908)

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More than 35 complex expeditions were organized by authors for investigation of consequences of the Tunguska catastrophe of 1908. The studies of the Tunguska explosion has shown that, besides the classic meteoritic destruction in the region of the fall, there are also a number of extraordinary post-effects (geomagnetic storm, reverse magnetization of rocks and soils, isotopic shifts, various biological consequences etc.). Careful studies of all consequences caused by collision the Earth with the small bodies of the Solar System is aim of an international program created by authors.

KEY WORDS Meteorite, explosion, ecological consequences, modelling, mapping, prognosis, laboratory experiments

INTRODUCTION

A considerable amount of observational material concerning the Earth encounters with small bodies of the Solar system and the bombardment rate of our planet is available now. A characteristic scale of repetition of such events is 0.001...10 millions years.

A catastrophic destruction in the region of the event, climatic changes and the disappearance of species of animals and vegetation caused by changes in the environment are usually considered in the literature as main after-effects of the collision events. The example of the Tunguska explosion has shown that, besides these effects, there are also extraordinary phenomena such as geomagnetic storms, reverse magnetization and thermo-luminescent changes of rocks, minerals and soils, isotopic shifts of the composition of biota and abiota in the catastrophe region and, most unexpectedly, various biological (including genetic) violations of flora, fauna and

humans have been detected. These facts have a fundamental meaning since they prove the presence of cosmic factors governing the development of the organic world of the Earth by means of bombardment by small bodies of the Solar System, and evolution caused not only by changes of the environment and climate, but also by direct mutations.

Taking into account the above-mentioned material we think that the questions of essential extension and of adequate financing of the investigations of the Tunguska catastrophe of 1908 should be solved without delay. It requires, first of all, the preservation of the object of investigation, namely the biocenoses and the landscape of the catastrophe region. A reliable guarantee of the safety of the Tunguska region could only be the declaration of it as a cosmic-biospheric reservation, possibly under the aegis of the UNESCO with a corresponding international program of investigation. Such a complex scientific program for the studies of the ecological consequences of a collision of the Earth with the Solar System small bodies is proposed below.

The program aim is to study the ecological consequences of the Earth's collisions with small bodies of the Solar System on the basis of a thorough investigation of the Tunguska catastrophe that took place on 30 June 1908, to estimate the probability of such events and to give a prognosis of the Earth collisions with known small bodies, to work out international measures for the Earth safety.

The program includes the following complex problems:

1. Elemental and isotope biogeochemistry of the fall region using the example of the Tunguska Meteorite Reserve;
2. Geophysical consequences of the Earth's collisions with small bodies of the Solar System;
3. Ecological (medical-biological) consequences of collisional events;
4. Prognosis and estimation of the probability of collisions of small bodies of the Solar system with the Earth;
5. A project of international measures aimed at the Earth defence against collisions with small bodies of the Solar System.

The complete text of the proposed program, taking into account earlier investigations in the Tunguska Meteorite Reserve, is described below.

A PROPOSED PROGRAM FOR RESEARCH IN THE TUNGUSKA REGION

1. Elementary and isotope biogeochemistry of the fall region using the example of the Tunguska Meteorite Reserve.

1.1. Study of an elementary composition of biota and abiota of the Tunguska region.

1.1.1. An exposure of the cosmo-chemical anomaly in the Tunguska Reserve by studies of soil, trees and peat composition.
1.1.2. Drawing a map of the chalkophile elements in the vegetation and ground of the Tunguska region.
1.1.3. Investigations of elementary correlations of rare earths in the soil and peat in the center of the catastrophe.
1.1.4. Search for an iridium anomaly in the Tunguska Preserve.
1.1.5. Reconstruction of the elementary composition of the Tunguska cosmic body.
1.2. Search for isotope changes of biota and abiota composition in the region of the Tunguska body destruction.
1.2.1. Studies of the isotope shifts for carbon, hydrogen, oxygen and lead in the soil and peat of the Tunguska catastrophe.
1.2.2. Selection of samples of trees for dendro-chronological and chemical analysis.
1.2.3. Search for isotope content of noble gases adsorbed in the natural objects of the Tunguska region.
1.2.4. Reconstruction of the isotope content of the Tunguska body.
2. Geophysical consequences of the Earth's collisions with the small bodies of the Solar System.
2.1. Physico-mathematical modelling of the large-space body interaction with the Earth's atmosphere and surface.
2.1.1. Construction of physico-mathematical models of the motion and explosion of large meteorites in the Earth's atmosphere. The determination of the ricoshet body class.
2.1.2. Creation of a contour map of the aerodynamic pressure from the model and its comparison with the map of fallen trees in the Tunguska region.
2.2. Investigation and interpretation of electromagnetic effects caused by the Tunguska event.
2.2.1. Mathematical model of electromagnetic phenomena caused by the motion and explosion of space bodies in the atmosphere of the Earth.
2.2.2. Search for possible mechanisms of the geomagnetic effects of the 1908 event.
2.2.2.1. Comparative studies of the geomagnetic effects of nuclear and large non-nuclear explosions.
2.2.2.2. Determination of the physical parameters of the source of the geomagnetic effect.
2.2.3. Studies of the nature and the mechanism of the local remagnetization of the soil in the region of the catastrophe.
2.2.3.1. Mapping the paleomagnetic survey results in the Tunguska region.
2.2.3.2. Comparative studies of the residually magnetized soil from the Tunguska Reserve and nuclear test field.
2.2.3.3. Determination of the physical parameters of a source which give the recent magnetic effect in the soil and rock.
2.2.4. Working out an electrophonic phenomenon theory describing large bodies moving in the Earth atmosphere and estimating the physical parameters of an electrophonic source of the Tunguska catastrophe.

2.3. Studies of the influence of the electromagnetic radiation of the Tunguska explosion on the vegetation and ground cover.
2.3.1. Search for the reason and parameters of the forest-fire in the Tunguska region.
2.3.2. Investigations of the influence of the Tunguska explosion on the vegetation and ground cover.
2.3.2.1. Mapping thermo-luminescent anomalies and residual radioactivity of the rock and soil in the catastrophe region.
2.3.2.2. Laboratory experiments of the thermal and radiation influences on the rock and soil.
2.3.2.3. Determination of the physical parameters of the source which give the thermo-luminescent anomalies in the Tunguska Reserve.
2.4. Investigations of atmospheric anomalies of the Tunguska event.
2.4.1. Determination of the characteristics of luminosity in the twilight and night skies of 1908 summer and estimation of the physical parameters of the luminosity source.
2.4.2. Search for transparency and polarization properties of the Earth's atmosphere of 1908–1912 in order to determine the initial parameters of the destroyed space bodies of the Tunguska epoch.
2.4.3. Investigations of the mechanisms and geophysical consequences of the breach of the ozone atmosphere layer caused by the Tunguska event.
2.5. Search for a possible distribution ellipse of fragments of the Tunguska body which were separated before the explosion.
2.5.1. Mathematical models of the crushing meteor body process.
2.5.2. Search and mapping of the Tunguska body's fragments.
3. Ecological (medical-biological) consequences of collisional events.
3.1. Studies of the restoration of the biomes after Tunguska event.
3.2. Investigation of the genetic background mutations of the plants in the Tunguska region.
3.3. Investigation of the genetic mutations of insects and other animals in the Tunguska Reserve.
3.4. Studies of the genetic characteristics of the micro-organisms in the ground from Tunguska region.
3.5. Genetic and immune-genetic characteristics of the aboriginal and non-aboriginal population of the southern part of Evenkia.
3.6. Search for the origion of the increased growth of the forest in the epicenter of the Tunguska catastrophe.
3.7. Comparative research of the genetic changes in other catastrophe regions (sites of nuclear explosions, volcano eruptions, forest fires, gas explosions, etc.).
4. Prognosis and estimation of the probability of collisions of small bodies of the Solar System with the Earth.
4.1. Construction of a spatial model for the density flux of the Earth-crossing small bodies of the Solar System.
4.2. Estimation of the collision probability with small bodies.
4.3. Compilation of a catalogue of Earth-crossing small bodies.

4.4. Investigations of the orbital evolution of the listed small bodies for the next 200–300 years.
4.5. Long-term prognoses of the possibility of the Earth's approaches to small bodies.
5. A project of international measures for defence of the Earth against collisions with small bodies of the Solar System.
5.1. A project to search for small bodies (with diameter more than 10 meters) crossing the near-Earth space.
5.2. A project to determine the destruction of small bodies or change of their orbital elements in the collisional cases.

We hope some organizations, institute, universities or private persons will find to be our Program interesting and we shall enjoy their support.

PROOF NOTE (from Editorial Board)

The conference on the topic of the programme has been held 17–26 July 1995 in Moskow, Tomsk, Vanavara (nearly village to place of Tunguska Catastrophe), and on the place of Tunguska Catastrophe. The meeting collected more than 150 participanties from Russia, Ukrain and Several other countries (Unaited Kingdom, Belgium, New Zeland etc.).