Strategy "Sochi 2014" consists of four key directions: Games in Harmony with Nature; Games with Minimal Impact on Climate; Zero Waste Games; Enlightenment Games.

In general, Environmental Program is a set of environmental measures to support the XXII Olympic Winter Games and XI Paralympic Winter Games of 2014 in Sochi, provided by the previously approved and implemented programs. The Environmental Program takes into account the experience in the field of environmental protection and sustainable development gained during the arrangements of the Games in Vancouver (2010) and London (2012).

Together with Environmental Program the "green" standards system is applied for saving unique nature during Olympic venue construction carried out in accordance with requirements of BREAM standard [4].

Simultaneously, the federal laws were developed. The Federal Law of 01.12.2007 N 310 "On the organization of the XXII Olympic Winter Games and XI Paralympic Winter Games of 2014 in Sochi, the Development of Sochi as a mountain resort and Amendments to Certain Legislative Acts of the Russian Federation". This federal law regulates the relations resulting from organization and holding of the XXII Olympic Winter Games and XI Paralympic Winter Games of 2014 in Sochi and development of Sochi as a mountain resort [2].

The Federal Law of 30.10.2007 N 238 -FZ "On the State Corporation involved in Construction of Olympic Venues and Development of Sochi as a mountain resort" was adopted. In accordance with Article 1 of this law the legal status, organizational principles , objectives and activities of creation , order of management activities, reorganization and liquidation of the order of the State Corporation on Construction of Olympic Venues and Development of Sochi as a mountain resort were established [3].

Having analyzed regulatory support in the field of environmental support construction in the resort areas, we can conclude that there is some inconsistency of the Russian legislation regulating the activities in the resort areas and protected natural areas. In particular, the program for the development of Sochi as a mountain resort ignores the requirements of the Federal Law "On Specially Protected Natural Areas" (1995). For example, according to Article 13 the function of national parks consists in preserving natural systems, rather than vice versa. Article 15 of the Act prohibits any activity that could do harm to natural complexes of flora and fauna and contradicts to the aims and objectives of the National Park [4].

The XXII Olympic Winter Games and the XI Paralympic Winter Games 2014 in Sochi will leave its imprint in sports and socio-economic history, and will, surely, have an impact on the environment. Meeting the requirements of "green" standards and the development of new legal acts provide maximum reduction of the negative impact of the Olympic facilities on the environment. In this respect, the XXII Olympic Winter Games and the XI Paralympic Winter Games 2014 in Sochi Games can become the act of environmental education for similar future construction.

References

1. Conservation program of animals rare and endangered species and plants in the Sochi National Park and the Caucasian State Nature Biosphere Reserve named H. Shaposhnikov in the implementation of the Olympic venues construction program.
2. The Federal Law of 01.12.2007 N 310 On the organization of the XXII Olympic Winter Games and XI Paralympic Winter Games of 2014 in Sochi, the Development of Sochi as a mountain resort and Amendments to Certain Legislative Acts of the Russian Federation.
3. The Federal Law of 30.10.2007 N 238 -FZ On the State Corporation involved in Construction of Olympic Venues and Development of Sochi as a mountain resort.
4. Vega A. Ecological and economic regulation development in the construction of facilities in the resort areas: Dissertation author's abstract on scientific degree of candidate of economic sciences. - Moscow, 2010.
5. Ministry of Natural Resources and Environment of the Russian Federation [Internet resource] – Retrieved from: URL:www.mnr.gov.ru/greenstandarts/ (access date 28.02.2014)
6. The Organizing Committee's attachment to the principles of sustainable development is set out in its core documents [Internet resource] – Retrieved from: UPL:www.sochi2014.com/ (access date 28.02.2014)

THE CAUSES OF HIGH SOIL RADIOACTIVITY IN CHINESE PROVINCE GUANGDONG

A.N. Zlobina
Scientific advisors professor L.P. Rikhvanov, associate professor I.A. Matveenko
National Research Tomsk Polytechnic University, Tomsk, Russia

There are several provinces on the globe that have high content of natural radioactive elements in soil. The examples are soils of Poços de Caldas province of Minas Gerais State in Brazil, that of Newe Island as well as soil in the South-Chinese Province Guangdong (Eisenbud, 1997 et al).

The character of soil radioactivity varies from pure radioactive (U > Th, which is typical for soil of Newe Island) to mixed uranium-thorium (Th/U > 2.5-5) and thorium (Th/U > 5, as it is in the soil of Guangdong Province). For the latter it has been suggested that its radioactivity is explained by the presence of monocyte.

As a reason for the formation of high natural radioactive concentrations in soil can serve, first of all, elevated concentrations of these elements in primary parent rocks and various geologic processes leading to accumulation of radioactive elements, for example, insolation processes of uranium accumulation as well as anthropogenic contamination with radioactive components in vicinity of mining factories (Rikhvanov, 2009).

The purpose of the given work is to study the causes of high soil radioactivity in the South-Chinese Guangdong Province. The preliminary gamma-spectrometric soil analysis (soil samples weighting 238 g) has shown that they are characterized by thorium radioactive nature (Th-190 Bq/kg; U (in terms of Ra) -120 Bq/kg ; K-150 Bq/ kg).

The operational soil research by the instrumental neuron activation analysis in the Nuclear Geochemical Laboratory of the Geoecology and Geochemistry Department (made by A.F. Sudyko, an analyst) has revealed that the content of Th in soil amounts 43.6 g/t, but U-9.2 g/t). Particular attention is drawn by its high concentration in the rare earth soil (∑ TR = 134.5 g/t), particularly Ce and Nd. Low content of Ca, Fe, Na and high content of U, Th as well as rare earth elements suggests that the original substrate for soil formation was potassium granite which is proved by the presence of silica relics and K-feldspar in soil.

For further research the separation of silt-loam fraction of the given soil was performed. Its portion amounted 37.4 % of the total sample weight.

Sand soil fraction (of > 0,01mm in size) was subjected to the classic sieve analysis. By the fraction of > 2 mm in size is accounted for 21% and it is presented in the form of quartz intergrowth and feldspar. It has been excluded from further chemical and mineralogical study. The portion of heavy minerals as a part of sand fraction amounted 0.2%, that is 0.05 % of the total soil volume. The heavy fraction was separated into magnetic, weakly magnetic and unmagnetic fractions by means of superpowerful Sm-Nd (samarium – neodymium) magnet.

Further mineralogical analysis of those fractions was made with the use of optical (binocular microscope) and electron-microscopic (electron microscope Hitachi S-3400N) research methods. Isolated grain soil fractures were tested for the presence of radioactive, rare-earth and a number of other elements by the instrumental neuron activation method (Fig.1). The data analysis showed that maximum accumulation of radioactive elements was found in fraction – 0.04 and clay fraction. In addition, maximum accumulation of U was revealed in the fine sand fraction (22.7 g/t), but Th – in the clay fraction (110.4 g/t). Thorium-uranium relationship in them varies from 4.3 to 9 respectively. In fine sand (<0.04) and clay (<0.01) fractions there was maximum accumulation of rare-earth, Ta and a number of other elements.

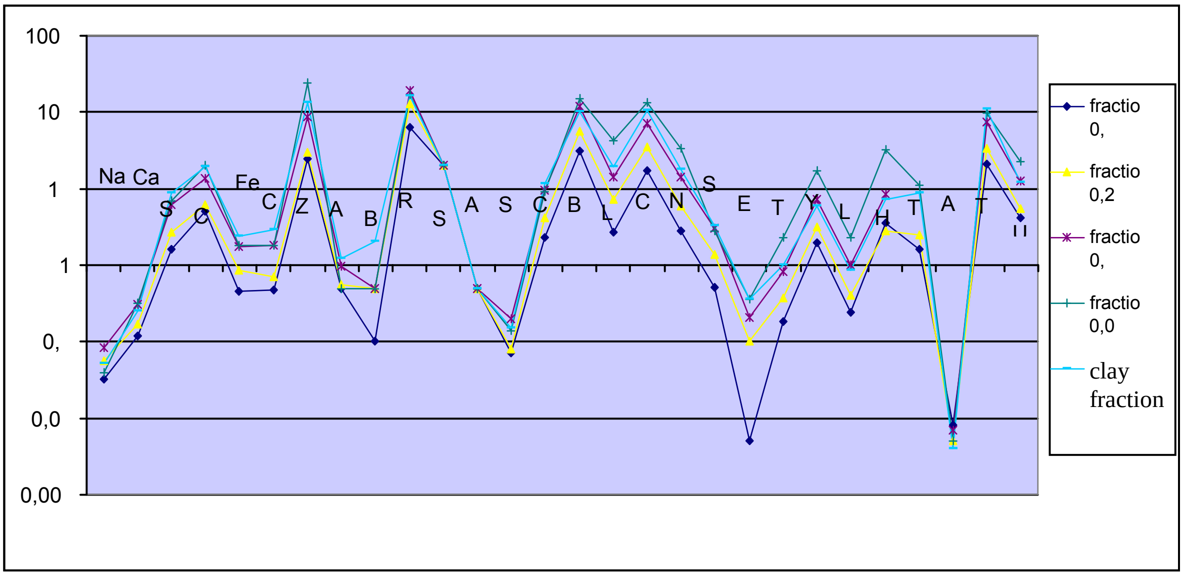

Fig. 1 The elemental composition of soil Guangdong Province by the instrumental neuron activation analysis

Therefore, silt-loam soil fraction was subjected to further more detailed study. Its chemical analysis showed that 81.45 % was conditioned by the presence of Si and Al oxides with the ratio SiO2: A12O3 = 1.5. Whereas the content of Fe oxides accounts for 3.63 %. The content of alkaline elements was low and equaled 1.34 %, besides, 1.3% was accounted for by K2O.

The content of organic hydrogen in soil was low, only 0.14 %. Of its total amount 24.6 % was accounted for by fulvic acid hydrogen.

The research of mineral composition of silt-loam fraction by the X-ray structure analysis has shown that kaolinite dominates in it (Al2[OH4]Si2O5), there are great deal of hydrargillite (Al[OH] 3), chlorite and quartz as well as insignificant admixtures of mica, K-feldspar, illite-chloritic aggregates, and hematite.

In view of the results of the optical and electron-microscopic research in heavy fraction it was stated that clay particles crooked with fine mixture of hydrargillite and adhesions of hematite predominate in it. In these aggregates the unclear mineral phase is visible. In terms of its composition it represents neodymium and iron oxides (Fe-47.9%, Nd-13.6%, O-35.3%). In some cases the grains of thorium-containing zircon (Th up to 2.2%), cassiterite are noticeable.

In the clay fraction were identified phosphates heavy and light rare earths, monazite, torit and rare earth cerium phase with thorium. The most common minerals are iron and titanium oxides, copper and zinc compounds (such as brass), zircon and barite. Also present are silver gray trace minerals may sulphide silver (not possible to accurately diagnose) micromineral formation bismuth and sulfur dioxide, zirconium (baddeleid), copper-nickel compound.

The leaching of uranium was conducted using various solvents (ammonium carbonate, nitric acid, water) to determine the location of forms. A series of experiments with the addition of hydrogen peroxide to ammonium carbonate at various stages of leaching to identify the nature of the compounds extracted uranium. The samples were examined on the analyzer Fluorat 02-Panorama. The results of experiments on the extraction of uranium are shown on the graph (Fig. 2).

The first curve on the graph shows that in the resulting 6 boiled with water (H2O) was removed not more than 0.24 g/ton uranium. Leaching with the addition of nitric acid (HNO3) was more effective (0.91 g/t). The ammonium carbonate (5% solution of (NH4)2C03) needs a solution, especially hexavalent uranium. To remove the tetravalent uranium requires its pre-oxidation, which was carried out by adding a small amount of hydrogen peroxide (H2O2), which was carried out at different stages of leaching. The third line shows low extraction of uranium (0.9 g/t), which was conducted only with pure solution of ammonium carbonate. On the 4th curve it can be observed that after three boiling with a solution of ammonia was added to a solution of hydrogen peroxide, which significantly increased the percentage of leaching. With the addition of hydrogen peroxide from the beginning of boiling (curve 5) are as a result of boiling 1 was recovered 1.12 g/ton uranium. The most effective was leached in this manner (1.5 g/t).

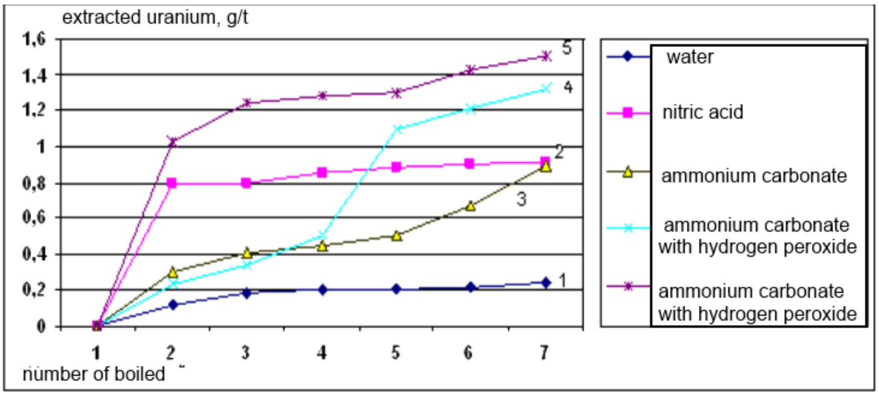

Fig. 2 Graph of leaching of uranium from the clay fraction

In summary, these experiments on leaching of uranium from clay fraction showed that the uranium is highly soluble compounds, and part of a close relationship with the clay component in the form of isomorphic impurity in accessory minerals.

As a current hypothesis it can be suggested that in our case we are dealing with the sorption concentration mechanism of U, Th, rare-earth elements on kaolinite- gibbsite soil aggregate. In this case it is not ruled out that proper rare-earth nanominerals are formed on this catalytic barrier that can explain the presence of iron - neodymium phase in them. The high natural radioactivity of soils Chinese province of Guangdong is associated with a high content of radioactive elements in the predominantly fine clay fraction.

The elevated concentration of radioactive and rare-earth elements in the studied soil is likely to be characterized as "ionic" ore type occurring in the territory of China.

In the course of the work performed it was stated that highly radioactive soil of China had been formed due to deep chemical weathering of highly radioactive potassium granites. High uranium and thorium contents in them are conditioned by specific conditions of weathering crust formation and subsequent pedogenesis. According to Hiroshige Morishima a.e. (2000) high dose loads for a man are formed in the development fields of such rock types.

Reference

1. Eizenbud M., Geselit. Enviromental Radioactivity from Natural – Industrials and Military sources. – San. Diego – London – Boston – New York – Tokio – Toronto, Academic Press, 1997. – 639 p.
2. Rikhvanov L.P. Radioactive elements in the environment and the radioecological problems: Manual. – Tomsk, 2009. – 428 p.
3. Morishima H., Koga T., Tatsumi K. a.e. Dose Measurement, Its Distribution and Individual External Dose Assessments of Inhabitants in the High Background Radiation Areas in China./J. Radiat. Res., 41: Suppl. – 2000. - pp. 9–23.
4. MacDonald G. Shanghai & Southern China Including Hong Kong. - 2009. - 176 p.