

A Study of Selected Rurik Dynasty Burials by the NAA Method

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Group of Neutron Activation Analysis of Frank Laboratory of Neutron Physics of Joint Institute for Nuclear Research (FLNP JINR) analyzed unique samples of bone remains of members of the ruled dynasty of Rurik: 1) Princess Maria Borisovna of Tver (1442- 1467), first wife of Grand Prince Ivan Vasilievich III of Moscow, and 2) Ivan Vasilievich IV the Terrible (1533- 1585), Grand Prince and Sovereign of Moscow, who in 1547 took the title "Tsar".

Princess Maria Borisovna died young. Taking under the attention the political reasons of her marriage with the Grand Prince of Moscow state, in order to strengthen the alliance of the principalities of Tver and Moscow, and further subsequent changes of the political goals of Ivan III, the Princess of Tver became an inconvenient figure. So her death appeared very "timely" even to her contemporaries.

About the death of Ivan the Terrible there is more information from manuscripts, but the elemental analysis of his bone remains, has added some information about the lifetime ailments of the first Russian Tsar. The data obtained can also present in a new perspective the reasons of wide known odious peculiarities of his manners and his character, previously explained by the difficult circumstances of his childhood.

The elemental research was made with the help of neutron activation analysis (NAA). The samples were irradiated using the IBR-2 reactor at the FLNP JINR and the WWR-K reactor at the Institute of Nuclear Physics, Almaty, Kazakhstan.

As a result, the mass fractions of 31 elements were calculated in the samples. In bone samples of both Ivan the Terrible and Maria Borisovna, an excess of Fe was found in comparison with the remains of their contemporaries buried in medieval cemeteries in Denmark. In the remains of Maria Borisovna, an increased content of Zn, Hg, and As was found. In the bones of Ivan the Terrible, the content of magnesium is twice as low as in the bones of Maria Borisovna. The elements found may be of both lifetime and postmortem origin. When interpreting the results, the fact of diagenesis was excluded (or confirmed), and differences in the conditions of burials in the Sobornaya Square of the Kremlin and in the necropolis of the Resurrection nunnery were taken into account. Diffusion of some elements into the skeleton bones from textiles and clothing accessories as well as from soil and precipitations is possible, given the age of the burials and changes in the environment of Moscow Kremlin area in the 19th and 20th cc.

A study based on an interdisciplinary analysis of the different kinds of sources added to the information about the elemental composition of the remains of the Russian medieval elite and opened up new opportunities to revise established comprehensions about lifestyles and diet of nobility. It allowed to assert that members of the ruling dynasty used plenty of medicines and cosmetics based on mercury and arsenic during their lives, and, with a degree of probability, to state the differences for men and women of the royal family in the used materials of costumes, tableware and in their routine court practices. The data obtained allow us to hypothesize on the reasons of death of Maria Borisovna of Tver as a result of deliberate systemic poisoning of small doses of arsenic in cooptation with systemic unintentional abuse of mercury drugs. We also can revise the causes of cognitive traits of famous historical personalities, associated with lifetime imbalance of important microelements in the body.