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Investigations of 87Sr / 86Sr ratio in carbonate rocks by the MC-ICP-MS methodology

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Sr-chemostratigraphy of carbonate and phosphate marine sediments of different ages is one of the important directions in isotope geochemistry of strontium, including carbonate sediments, devoid of organic residues suitable for paleontological studies. The small scale of variations in the 87Sr / 86Sr ratio in carbonate rocks of marine origin determines high requirements for Sr isotopic analysis, first of all, for the accuracy and correctness of the results obtained. Taking into account these requirements, a methodology was developed in the Geothermochronology center of Kazan University. At the stage of chemical preparation, the problem of obtaining pure analytical preparations of strontium was solved. For this purpose, a set of chemical procedures has been implemented. This ensures a low level of background contamination of samples (less than 0.2 ng) of foreign strontium at all stages of chemical preparation, as well as high efficiency of separation of Sr from the matrix elements of the sample, including Rb. Certification of the method using carbonate samples showed that the Sr loss of the sample does not exceed 10%, and the Rb / Sr ratio in analytical preparations is less than 0.000002. The main tasks in the formulation of high-precision measurements of the Sr isotope composition were to select the optimal operating modes of the mass spectrometer, at which the maximum sensitivity of the device and the stability of ion currents are achieved, as well as to the evaluation of factors influencing the accuracy and accuracy of the analysis results, and in their accounting. Experiments with supporting single-element Sr solutions made it possible to determine the main parameters of operation of the MS NEPTUNE PLUS units equipped with a Jet-interface and to develop an analytical procedure for isotope analysis. It includes, inter alia, taking into account the influence of the effect of instrument mass discrimination, as well as isobaric interference overlays on the analyzed mass lines of Sr. isotopes. On the basis of the long-term reproducibility of the results of the analysis of the international standard sample of the isotopic composition Sr SRM 987, the accuracy and correctness were evaluated. For a series of parallel analyzes (n = 14) SRM 987, the average value of the ratio 87Sr / 86Sr = 0.710250 was obtained, which within the error coincides with the value of 0.710248 $\pm$ 11 adopted for this standard (Thirlwall, 1991). At the same time, in terms of the accuracy (0.0013%, $\pm$ 2SD) of the Sr analysis, the developed technique is similar to both the classical TIMS method and the methods implemented on the basis of the MC-ICP-MS method in other laboratories around the world. The effectiveness of the technique for the purposes of Sr-chemostratigraphy of carbonate rocks is confirmed by the results of the analysis of samples, for which coinciding results of parallel analyzes were obtained using the TIMS and MC-ICP-MS methods. The work was supported by the Ministry of Science and High Education of the Russian Federation contract No. 14.Y26.31.0029 in the framework of the Resolution No.220 of the Government of the Russian Federation