Comparison of element profiles obtained from Itrax-XRF core scanner in evaluating data quality among laboratories used by geological reference material.

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The non-destructively and high-resolution X-ray fluorescence (XRF) core scanner have become a useful tool for paleoenvironmental research as well as in many other fields. In Japan, two Itrax-XRF core scanner (Itrax) produced by Cox Analytical Systems, equipping different generations of XRF detectors, were set up at Center for Advanced Marine Core Research in Kochi University (CMCR, CS-38, first generation) at 2014 and National Institute of Advanced Industrial Science and Technology (AIST, CS-49, third generation) in 2019, respectively. In order to understand data quality of these two Itrax, six geological reference materials from different sedimentary environments (lake, marine and fluvial sediments produced in Geological Survey of Japan) were measured.
The reference materials were firstly filled in 2.2×2.2 cm sample cube and covered by a thickness of 1.4 μm PET film. These samples were measured in 100, 30, 15, 5, 1 seconds of exposure times using Molybdenum (Mo) and Chromium (Cr) X-ray tubes at 0.2 mm intervals, respectively. All the XRF spectra were reevaluated by the Q-Spec software (Cox Analytical Systems, version 15.1) to obtain individual element peak area. The continuous 50 measurements in the central part of scanning were selected and averaged to avoid possible edge error. These results (Al, Si, S, K, Ca, Ti, Mn, Fe, Ni, Cu, Zn, Rb, Sr, Ba, Pb) were further compared with the absolute concentrations of six reference materials and calculated the correlation coefficients (R^2) with each exposure times and X-ray tubes.
Beside the results using Mo X-ray tube at AIST (failed to measure due to the machine failure), we compare our results with the data using first generation XRF detector in National Taiwan University (NTU, CS-16 in 2009) that reported by Huang et al. (2016). The correlation coefficients of Si, S, K, Ca, Ti, Mn, Fe, Ni, Cu, Zn, Rb and Ba show high (R^2>0.90) among all the laboratories in all machine setting, while Al shows low (R^2<0.80). Therefore, we confirm that (1) the influence of different exposure times is insignificant for the accuracy of the scanning results; (2) Al is difficult to measure by Itrax due to its low detectability, even advanced XRF detectors in CMCR and AIST were used. More detailed discussion will be made once we obtain the Mo tube data of AIST.

Keywords: Itrax-XRF core scanner, data quality, geological reference material

