

APE031-P22

会場: コンベンションホール

時間: 5月25日 10:30-13:00

近赤外分光法による湖堆積物の非破壊・簡便評価 Non Destructive Prediction of Lake Sediment by Near-infrared Spectroscopy

稲垣 哲也¹, 篠塚 良嗣^{2*}, 山田 和芳³, 林田 明⁴, 米延 仁志³, 土川 覚¹, ティモ サーリネン⁵, 吉田 明弘⁶, 五反田 克也⁷, 星野 安治⁶, 大山 幹成⁶, 小田 寛貴⁸, 安田 喜憲⁹

Tetsuya Inagaki¹, YOSHITSUGU SHINOZUKA^{2*}, kazuyoshi yamada³, Akira Hayashida⁴, Hitoshi Yonenobu³, Satoru Tsuchikawa¹, Timo Saarinen⁵, Akihiro Yoshida⁶, Katsuya Gotanda⁷, Yasuharu Hoshino⁶, Motonari Ohyama⁶, Hiroataka Oda⁸, Yoshinori Yasuda⁹

¹ 名古屋大学大学院生命農学研究科, ² 北海道大学大学院地球環境科学研究科, ³ 鳴門教育大学, ⁴ 同志社大学理工学部環境システム学科, ⁵ トゥルク大学, ⁶ 東北大学学術資源研究公開センター植物園, ⁷ 千葉商科大学政策情報学部, ⁸ 名古屋大学年代測定総合研究センター, ⁹ 国際日本文化研究センター

¹Nagoya university, ²Hokkaido University, ³Naruto University of Education, ⁴Doshisha University, ⁵University of Turku, ⁶Tohoku University, ⁷Faculty of Policy Informatics, ⁸Nagoya university, ⁹Research center for Japanese studies

The feasibility of near-infrared (NIR) reflectance spectroscopy with aid of multivariate analysis, which is rapid, inexpensive, non-destructive and correct technology, for the prediction of organic and inorganic fraction in lake sediment is reported.

The core samples were collected in Lake Ogawara (40 49 06 N, 141 19 55 E, 0 m a.s.l.) which is a 25 m deep brackish water lake formed on along the Pacific coast in Aomori Prefecture, northeastern Japan. The lake sediment consisted of well-preserved annually formed lamina. This suggests that the long cores are possibly a high-resolution record of past environmental changes. In December 2009, three parallel cores of ~20 m in length were drilled nearly at the center of the lake. A continuous composite profile was established from these cores, which were all divided using plastic cubes (2.3 cm on a side). A total of 2,800 cubes were obtained.

Of the 2,800, 145 cubes (at about each 10 cm interval in core length up to 15 m in depth) were used for conventional and destructive geochemical analyses. Total organic carbon (TOC), total nitrogen (TN), total sulfur (TS) and C/N ratio were measured using an element analyzer (1108, Calbo Erba) and other inorganic compounds were measured using an inductively-coupled plasma atomic emission spectroscopy (ICP-AES, SPS 7700, Seiko Instruments Inc.).

NIR spectra were acquired in a diffuse reflectance mode using a FT-NIR spectrometer (MATRIX-F, Bruker) with fiber optics. To improve the signal-to-noise ratio, 64 scans were accumulated at a spectral resolution of 8 cm⁻¹ over the wavenumber range of 10,000-4000 cm⁻¹. Sediment samples used for conventional analysis were dried at the 100 OC for 24 hours before NIR spectral measurement to avoid the influence of strong absorption due to water.

Each sediments property was predicted from NIR spectra using partial least square (PLS) regression analysis. From the relationship between measured values and predicted values by PLS for each parameter and the observation of statistical results calculated, it is known that PLS analysis provided good regression models. The correlation for determinant for cross-validation of water content, TN, TOC, TS, Al₂O₃, Na₂O/Al₂O₃, S/Al₂O₃, Fe₂O₃/Al₂O₃ and Sc/Al₂O₃ were 0.68, 0.80, 0.77, 0.58, 0.81, 0.53, 0.68, 0.68 and 0.65, respectively. The root mean square error of cross-validation (RMSECV) for each PLS regression model was adequately small. These calibrations demonstrate the ability of NIR spectroscopy for accurately prediction of multiple sediment parameters without any conventional and destructive geochemical analysis.

キーワード: 近赤外分光法, 非破壊・簡便分析, 小川原湖, 気候復元