

# **Development of Basaltic Glass Reference Materials for Volatile Element Analysis (H<sub>2</sub>O, CO<sub>2</sub>, S, Cl, F) and Investigation of Water-Induced C Ionization Suppression in Silicate Glasses Using SIMS**

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We introduce the ND70-series, a novel set of reference materials designed for in situ analysis of volatile elements (H<sub>2</sub>O, CO<sub>2</sub>, S, Cl, F) in basaltic silicate glass. Synthesized in piston cylinders at pressures ranging from 1 to 1.5 GPa under volatile-undersaturated conditions, these samples cover a wide range of mass fractions: 0 to 6 wt.% H<sub>2</sub>O, 0 to 1.6 wt.% CO<sub>2</sub>, and 0 to 1 wt.% S, Cl, and F. The samples have been extensively characterized using multiple analytical techniques: Elastic Recoil Detection Analysis (ERDA) for H<sub>2</sub>O, Nuclear Reaction Analysis (NRA) and Elemental Analyzer (EA) for CO<sub>2</sub>, Fourier Transform Infrared Spectroscopy (FTIR) for H<sub>2</sub>O and CO<sub>2</sub>, Secondary Ion Mass Spectrometry (SIMS) for H<sub>2</sub>O, CO<sub>2</sub>, S, Cl, and F, and Electron Microprobe (EMP) for CO<sub>2</sub>, S, Cl, and major elements. The consistency between expected and measured volatile contents across different techniques and institutions is excellent. However, SIMS analyses of CO<sub>2</sub> mass fractions, using either Cs<sup>+</sup> or O<sup>-</sup> primary beams, are significantly influenced by the H<sub>2</sub>O content in the glass. The ND70-series reference materials are available to researchers at ion probe facilities in the US, Europe, and Japan. Remaining materials are preserved at the Smithsonian National Museum of Natural History and are freely available on loan to the scientific community.