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How to quantify volatile emissions from sedimentary host rocks during continental flood basalt emplacement?

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The coevality of continental flood basalts and global environmental changes might imply that volatile emissions during these magmatic events can significantly impact atmospheric composition, causing disturbances on climate and ecosystems over short timescales. Volatile emissions resulting from magma-sediment interactions (by contact metamorphism) in the shallow crust are considered to represent the main contributor to the volatile budget, releasing significant amounts of CO_2, SO_2, CO, and CH_4. In an attempt to quantify the extent of volatile release by thermal metamorphism into the atmosphere, we performed heating experiments simulating metamorphic conditions on sediment samples from the Paraná Basin (Paraná-Etendeka Magmatic Province) and the Amazonas Basin (Central Atlantic Magmatic Province), producing residual lithologies (post degassing) where fluids derived during experimental runs were trapped in-situ. Eleven experiments were conducted in Externally Heated Pressure Vessels (EHPV) with a cold-seal design at 600-650ºC and 100 MPa, using Ar-CH_4 mixtures as pressure medium and to constrain oxygen fugacity (ca. NNO-1 or lower). Ground shales, carbonates, and evaporites were loaded in Au-capsules along with cylindrical cores of unfractured inclusion-free quartz. Fluids outgassed from starting materials were trapped in-situ by thermal shock of the quartz cylinders. Starting materials and run products were characterized by XRF, EPMA, LA-ICP-MS, and XRD analyses to constrain the impact of volatile release on sedimentary lithologies. The synthetic fluid inclusions, when present, were evaluated by size, quantity, and chemical composition. The first results show that shales did not suffer significant chemical losses, with Mg being the most affected element (ca. 25% loss). The largest chemical changes occurred in the shale containing most organic compounds, but all shales exhibited a limited ability to release volatiles at the experimental conditions explored. Carbonates and evaporites show a greater potential for volatile release, where carbonates suffered significant losses in Ca and Mg after degassing, ranging from 16 to 49%.