As the MARGINS Subduction Factory experiment approaches the end of the 10-year program, a team of MARGINS-funded scientists and Japanese collaborators (led by Dr. J.-I. Kimura of IFREE/JAMSTEC) are working together to develop an EXCEL® spreadsheet calculator known as the Arc Basalt Simulator ver.2 (ABS2) and use this to compare arc magmas from the IBM and Central American focus sites. Four principal modules are involved, as shown on the associated figure. Recent development in experimental studies and thermodynamic models better constrain the phase petrology of slab components during prograde dehydration metamorphism and slab melting and the wedge mantle as it reacts with slab-derived fluids. ABS2 uses geodynamic models of thermal structure and estimates for the composition of subducted sediments and crust, and processes these using the PERPLE_X metamorphic model to predict the abundance of incompatible element and Sr-Nd-Pb isotopic compositions in a slab derived fluid and in an arc basalt magma generated by an open system fluid-fluxed melting of wedge mantle peridotite. ABS2 predicts the trace element and radiogenic isotopic composition of primitive arc basalts. Theoretical and empirical results from the MARGINS Subduction Factory experiment and IODP are key pieces of this effort. Drilling and marine geophysical studies constrain the age, thickness and composition of sediments and oceanic lithosphere entering these subduction zones, and how these change with increasing P and T inferred from geodynamic models that are appropriate to each subduction zone. Comparing IBM and Central America Subduction Factory focus sites using ABS2 promises new insights into the differing behaviors and products of these two endmember subduction factories.

Figure: Diagram summarizing the four ABS2 modules, which simulate geochemical reactions of (1) dehydration of subducted sediment and altered oceanic crust; (2.1) hydration of mantle-wedge sole and reaction with slab derived fluid; (2.2) fluid flow in the mantle with fluid mantle reaction, and (3) fluid-fluxed melting of the mantle wedge. This section is based on seismic tomography beneath NE Japan. Also shown are Moho depth, crustal structure, and mantle wedge isotherms (red dotted thin line with numbers (°C) and flow lines (thin black arrows). Light grey shaded area shows pressure interval modeled by ABS ver.2. Hydrous mineral stability fields are fitted to P-T conditions in the cross section. Chl: chlorite, Serp: serpentine, Amp: amphibole, Zo: zoisite, Cld: chloritoid, Law: lawsonite, RA: rear arc volcano, VF: volcanic front volcano. Yellow to orange shades in the mantle wedge are inferred from variations in Vs. Gray open dot: seismic foci, light blue arrow: fluid path, red arrow: basalt path, red triangle: volcanoes, Green area in slab: slab dehydration region, blue wedge at the sole of mantle: metasomatized peridotite, red and blue shaded areas in slab: estimated slab fluid source volcanic for VF and RA respectively, red and blue rectangles in mantle wedge: mantle melting regions estimated by ABS model, red small arrows: slab dehydration, thin blue arrows: fluid flow in mantle wedge, red thick arrows: basalt magma transfer.


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