Subduction - mantle plume interaction in Paleozoic Earth: evidence from facial- and chemo-stratigraphy of the Emeishan large igneous province, SW China

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Plate subduction and mantle plume activity are among the most important dynamic processes of our planet. Although it is widely believed that these two processes evolve independently from each other, recent reports emphasize the potential role of their interaction on petrogenesis and surface structures of some volcanic systems in Pacific northwest and southwest. So far, It is still poorly understood whether similar or other mode of interactions exist in Pre-Cenozoic eras.

Here we report mutually consistent evidence from the Emeishan large igneous province (ELIP), a Permian LIP located on the western Yangtze Plate (SW China), to demonstrate the existence of plume-subduction interaction in Paleozoic Earth. The main body of the ELIP is originated from melting of a mantle plume head, however, we found (1) the early-stage eruptive sequence on the western part of the ELIP records a pre-eruptive down-drowning environment along a N-S trending rift, parallel with nearby arcs in the Paleo-Tethys suture to the west; (2) In this area, a gabbroic intrusion developed beneath the volcanics and shows a subcontinental lithospheric mantle (SCLM) origin modified by subductional fluid, correlated both temporally and genetically with geochemistry of the ealy-stage volcanics mentioned above. These aspects imply the early-stage evolution of the western ELIP are affected by fluid-influnced back-arc extension of the Paleo-Tethys subduction. Overlying this seuqence, a short lava session developed showing a mixed features between lithosphere- and plume-derivation. This session is in turn overlain by thick volcanics originated predominantly from a plume source. These features (facies architecture and chemo-stratigraphy of the volcanics) support a reasonable explanation that evolution of the western ELIP is affected by Paleo-Tethys back-arc extension before domiated by plume in the following main eruption stage.