The Tonga-Kermadec arc – Lau back-arc: Recent progress and future research directions

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The last decade has seen concentrated geochemical and geophysical research effort in the Tonga-Kermadec arc – Lau back-arc subduction system. Detailed geochemical and geophysical studies on several individual volcanoes have placed new constraints on the composition of magma source regions as well as the systematics and timescales of partial melting, magma ascent aand differentiation and degassing. Complimentary studies in the Lau back-arc have provided new insights into mantle potential temperature, mantle flow and how melting systematics change with distance from the arc front. Both geochemical and geophysical data suggest that one compoonent of mantle flow is to the southsouthwest, parallel to the arc front. It is increasingly clear that the arc front and back-arc melting regimes overlap and are similar when the arc to back-arc spreading centre distance is < 80 km. In these regions, melting appears dominately fluid-fluxed. As this distance increases, slab-surface temeratures increase and the back-arc lavas become more MORB-like. In addition there is a change from fluid-fluxed to decompression melting and this seems to occur where seismic evidence suggests that the arc and back-arc melting regimes separate. In summary, our knowledge of this kay but complex subduction system has increased rapidly in the last decade. Future work could test and refine models for interaction of the arc and back-arc melting regimes and slab-surface temperatures. Proposed drilling, submersible and dredging legs afford the opportunity to constrain the temporal evolution of this arc and compare and contrast that with the evididence from the IBM arc for initiation at 52 Ma associated with a distincitive geochemical statigraphy of arc initiation.