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Temporal evolution of the swell and magmatic fluxes along the Louisville hotspot chain

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Hawaii and Louisville are the two long-lived hotspot chains in the Pacific basin. Characterizing the swell flux, Q_s, a measure of the plume buoyancy, and the flux of the magmatic material accumulated along the chain, Q_m, brings important constraints on the plumes' temporal evolution and on their interaction with the lithosphere. Numerous studies focus on the temporal evolution of the Hawaiian chain, but no study investigates the temporal evolution along the Louisville chain. In the present study we constrain the temporal evolution of the swell and magmatism fluxes along the Louisville chain. Our study is based on bathymetry data and on volcano ages. The overall Louisville magmatism flux appears to show a modest increase over time but when features created by shallow phenomena are taken into account and excluded, the flux appears nearly constant, i.e., Louisville plume activity has exhibited remarkably little variation over the past 30 m.y.,in agreement with geochemical data. These results are also in agreement with recent studies along Hawaii, which show that the $Q_m$increase is due to plume migration towards a more fertile mantle reservoir. This means that, in general, long term variations in Q_m relate to variations in the deep source of the plume. Along Louisville, we find short-term variations that occur with a periodicity of ~5-10 m.y. in both Q_m and Q_s, similar to the short-term variations observed along Hawaii by former studies. As these variations occur along hotspot chains associated with either a heterogenous or homogeneous chemical signature, they must be created by shallow phenomena. The tilt of the plume conduit by large-scale mantle advection is our preferred model, as it can account for both the geophysical and geochemical observations.