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Chemical variations in granitic magmas: source-inherited or products of magmatic processes?

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Though exhibiting considerable scatter in the data, geochemical variations in granitic plutons and silicic volcanic deposits are commonly modelled as the products of differentiation of originally homogeneous magmas. However, many silicic igneous bodies are internally heterogeneous in their mineralogy, geochemistry and isotopic ratios, on a variety of scales, down to 1m or less, and this variation is mainly inherited from the magma source regions. Granitic plutons and silicic volcanic complexes are therefore commonly constructed by the accumulation of numerous (sometimes quite small) batches (pulses) of magma derived from contrasting source rocks. Such pulses result from the nature of the melting reactions and the physical structure of magma source regions. Internal differentiation of these batches can occur, but most probably not on the scales of whole magma chambers. Rather than being created through differentiation or hybridisation processes, at or near emplacement levels, much of the variation observed within such magmatic bodies (e.g., trace-element or Mg# variation with SiO_2 or isotopic ratios) is therefore a primary feature. At emplacement levels, the relatively high viscosities and slow diffusion rates of many chemical components in silicic melts probably inhibit processes that would lead to magma homogenisation; this permits at least partial preservation of the primary heterogeneities.