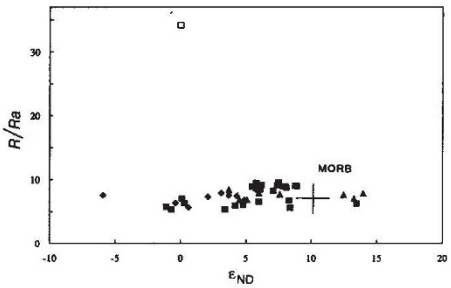
Volcanic traces

SIR—Numerous chemical and isotope studies[1,2] of xenolith samples carried to the surface by volcanic eruptions have revealed a common pattern of enrichment in incompatible trace elements, accompanied by only minor amounts of basaltic components such as silicon, aluminium, calcium and titanium. Termed 'metasomatic' enrichment (especially where the addition of the light rare-earth elements is involved), this process has been attributed to the action of mantle fluids enriched in trace elements, capable of modifying the content of trace elements in rocks through which they pass without discernible effect on the composition of major elements[2]. Support for this view comes from the common occurrence of CO_2-rich fluid inclusions in xenoliths and experimental indications of high rare earth solubility in both carbonate melt and CO_2 (refs 3,4). However, measurements of trace element solubilities in CO_2 at high pressure and temperature remain in conflict. Meen *et al.* recently[5] failed to substantiate the earlier experimental results: their experiments suggest distribution coefficients $K_D^{CO_2/diopside}$ for Nd at least as low as 0.5 and probably less then 0.05 at high pressures and temperatures, implying a limited role for CO_2-rich fluids as agents of rare-earth element transport in the mantle. Our isotope measurements on xenolith samples support the experimental conclusions reached by Meen *et al.*[5].

Helium isotopes are ideal tracers of fluid movement in the crust and mantle, partitioning strongly into fluid in equilibrium with melt or solid phases[6]. Helium in xenolith samples resides predominantly in their (invariably CO_2-rich) fluid inclusions[7-9]. The isotope covariation of neodymium with He provides a test of the fluid-phase partitioning behaviour of Nd — if mantle fractionations of U/He and Sm/Nd remain coupled, and Nd were to move with He in metasomatic fluids, He and Nd isotope signatures should vary sympathetically.



He–Nd isotope relationships in ultramafic xenoliths. The wide range of Nd isotope compositions (expressed as $\varepsilon_{Nd} = 10^4(^{143}Nd/^{144}Nd_{sample}/^{143}Nd/^{144}Nd_{CHUR} - 1)$, where CHUR indicates a reservoir with chondritic $^{147}Sm/^{144}Nd$ ratio) contrasts with uniform, mid-ocean-ridge-basalt-like He isotope compositions (sample $^3He/^4He$ ratios (*R*) normalized to the atmospheric ratio (*Ra*). Note that radiogenic He plots at low *R/Ra* values (less than 0.1). Diamonds, continental samples; triangles, convergent margin samples; closed squares, ocean island samples; open square, primitive components.

He and Nd isotope data for ultramafic xenoliths have been reported by us[7-9]: in the figure we illustrate these results for an extensive set of continental and oceanic samples. Over an extreme range of sample Nd isotope compositions, He maintains a strikingly uniform composition indistinguishable from that of the convective mantle as sampled by mid-ocean ridge basalts. The wide-ranging Nd isotope compositions of the xenoliths may result from inputs from other geochemical reservoirs[8], or from long-term isolation in the lithosphere. However, they are decoupled from He isotope effects. Neither primitive ^{3}He-rich, nor ^{4}He-rich compositions indicative of ageing in the lithosphere, are observed in the samples. The He and Nd carried by the samples come from separate reservoirs, with separate fractionation histories. The data imply that these elements do not move together in metasomatic fluids.

Decoupling of these systems may be thought of as reflecting addition to the lithospheric mantle of a He-rich, Nd-poor component. The high He component is likely to have been associated with CO_2, now present in fluid inclusions.

The xenolith data document widespread access of volatiles from the convecting mantle to the lithosphere beneath regions of alkaline volcanism. They support the results of Meen *et al.*[5], suggesting that these CO_2-rich fluids are not significant carriers for the rare earth and perhaps other trace elements, such as strontium[7-9], in the mantle lithosphere.

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Hepatocytes and scatter factor

SIR—Scatter factor, a cytokine secreted by certain fibroblasts, enhances the movement and causes the dissociation and scattering of epithelial cells[1-3], and may be involved in epithelial migration, for example in embryogenesis[2]. Mouse scatter factor has an apparent relative molecular mass of 62,000 (62K) in non-reducing SDS gels and is composed of two subunits of 57K and 30K held together by disulphide bonds[3]. We have obtained an amino-terminal sequence of the 30K subunit and notice that it is very similar to that of the smaller subunit of hepatocyte growth factor/hepatopoietin A, a potent mitogen for rat hepatocytes which has been implicated in liver regeneration *in vivo*.

		Ref.
Mouse scatter factor	VVNGIPTQTTVG?MVSLLYRN?HI	
Rat hepatocyte growth factor	----------W----K---K--	4
Rabbit hepatopoietin A	----K--RT-V-R----K---K--	5
Human hepatocyte growth factor	-------R-NI-W----R---K--	6
Human hepatocyte growth factor	-------R-NV-W-I--R---K--	4

The sequence data suggest that scatter factor and hepatocyte growth factor/hepatopoietin A are either the same or highly related molecular species. Either way, the relationship is intriguing. Scatter factor was identified as a motility factor and, at least in MDCK cells which are highly responsive to motility stimulation, it has little effect on DNA synthesis and no effect on the rate of cell division[3]. On the other hand, hepatocyte growth factor/hepatopoietin A has no reported effect on cell motility.

If the scattering and mitogenic activities are due to the same protein, it is tempting to suggest that different classes of receptors mediate the effects on growth and movement in different types of cells or tissues. If they are due to related but different proteins, it is clear that the two factors are members of a new group of cytokines that control both epithelial movement and growth. Coordinate regulation of cell migration and division is a key feature of many developmental processes and repair reactions.

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