been overprinted by an influx of chondritic material that occurred after core formation. That the mantle composition was set by metal–silicate equilibrium seems unlikely, in the light of these results.

The findings by Day and colleagues are consistent with an earlier report of relatively high levels of highly siderophile elements and chondritic relative abundances in diogenites and other types of differentiated, early-formed meteorites⁷. A notable difference between the two studies^{2,7} is in the estimate for the highly siderophile element content of the mantle of the diogenite parent bodies. Day and colleagues conclude that highly variable levels of chondritic additions, of about 0.001% to 1%, are required to produce the measured diogenite compositions, indicating an inhomogeneous parent-body mantle. This would suggest that mixing of the veneer into the parent-body mantle was inefficient, and that the total amount of late veneer delivered cannot be constrained accurately.

In contrast, Dale *et al.*⁷, use the composition of diogenites, as well as more

lava-like meteorites from the diogenite parent bodies, to suggest a relatively small chondritic component to the mantle silicate budget, of about 0.01 wt%. The estimated amount of chondritic addition to the martian and terrestrial mantles are about 50 to 100 times higher, respectively. So if this interpretation is correct, it would be consistent with the amount of late veneer scaling with planet size — and hence cooling rate, duration of accretion and possibly redox state.

These two different views can be resolved only when the effects of igneous processing on the diogenite parent bodies are constrained better than at present⁸. But together, the findings^{2,7} suggest that many of the differentiated planetary bodies sampled thus far have gone through a late accretionary stage following a main core-forming event — despite different durations for accretion, and a high likelihood that the composition and size distribution of impacting material varied.

The measurements presented by Day and colleagues² constrain a poorly

understood aspect of planetary accretion: they demonstrate that a chondritic veneer was added on to some differentiated bodies early in the evolution of the Solar System. The results indicate that ongoing addition of material after the main stage of accretion and core separation could have been a widespread process during planetary formation. □

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HYDROLOGY

Supply and demand

With a global population of over seven billion and growing, the demand for natural resources has never been greater. If future requirements for food and water are to be met, the Earth's resources must be used sustainably.

Attempts to manage the world's natural resources have led to the development of a number of sustainability measures. The ecological footprint, for instance, denotes the area of land required to sustain a population.

As with land, groundwater has become scarcer; extraction has increased sharply in recent decades to meet the domestic, industrial and agricultural needs of billions of people. As a result, groundwater levels have fallen in many parts of the world, particularly in regions where surface water supplies are sporadic or sparse. This has led to mounting concerns about the sustainability of groundwater supplies.

Using a global hydrological model and previously published estimates of groundwater consumption, Tom Gleeson and colleagues have estimated the global groundwater footprint — that is, the aquifer area required to sustain current rates of groundwater consumption and aquifer ecosystem services (*Nature* **488**, 197–200; 2012). According to

their calculations, the global groundwater footprint exceeds the area of hydrologically active aquifers by 3.5 times.

A spatially explicit analysis of individual aquifers reveals that this unsustainable exploitation of global groundwater resources is driven by abstraction in a few agriculturally important aquifers, primarily in Asia and North America. According to this analysis, around 1.7 billion people live in regions where groundwater use is unsustainable. Of those living in regions of groundwater stress, around 60% reside in India and China.

The concept of a groundwater footprint as devised by Gleeson *et al.* could prove instructive when it comes to agricultural planning and water management strategies.

A number of regions where agricultural yields could be improved, for instance, coincide with regions where aquifers are being used sustainably. And, by way of example, Gleeson *et al.* note that the transfer of just a small percentage of groundwater consumption from the Upper to the Lower Ganges in India could diminish, although not remove, groundwater stress in the region.

It is clear that current patterns of groundwater use in a number of agriculturally intensive regions of the world are not sustainable. Now that the problem has been identified and investigated quantitatively, it is time to act.

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Correction

In the News & Views article 'Hydrology: Supply and demand' (*Nature Geosci.* **5**, 592; 2012), the reference should have read '*Nature* **488**, 197-200; 2012'. This is correct in the HTML and PDF versions.