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## EDITORIAL OFFICE



490, rue de la Couronne  
 Québec (Québec) G1K 9A9 Canada  
 Tel.: 418-654-2606  
 Fax: 418-654-2525

Layout: POULIOT GUAY GRAPHISTES  
 Copy editor and proofreader: THOMAS CLARK  
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## GEMS, RICHES, WEALTH AND FINANCE



David Vaughan<sup>1</sup>

As I sit down to write this editorial, the world is faced with the greatest financial crisis since the Great Depression of the 1930s, possibly the greatest such crisis ever. It is perhaps an ironic coincidence that the theme of this issue of *Elements* concerns the highest-value materials we take from the Earth, the gemstones which have been symbols of wealth and power since the earliest civilisations. But we should not forget that the beauty of even the most modest of precious and semi-precious stones has also given great pleasure to many of us at one time or another.

Whereas the present financial crisis is a reminder of human greed and folly, gemstones are a reminder of the fact, not always appreciated by our political masters, that almost all of our material wealth comes from the Earth. As scientists specialising in Earth materials and Earth systems, we know only too well that this wealth is not limitless. Recent decades have seen a phenomenal increase in the volume of raw materials extracted from the Earth. Although supplies of some, like building stone and abundant metals such as iron or aluminium, are so vast as to ensure supplies into the indefinite future, for others, local or even global shortages are likely to arise relatively soon. The most obvious examples of this are the fossil fuels, particularly oil and gas, but more alarming are warnings over future supplies of water for drinking and other domestic use, and for the irrigation of crops. Some might advocate a return to a simpler way of life (living 'off the land'), but that is not an option with a world population of six and a half billion people and which is bound to grow by several billion more in the coming decades. It is also important to remember that feeding, clothing and housing our current population is only possible through the operation of complex systems involving numerous types of raw materials and technological and agricultural products. For example, world food production has only kept pace with population growth through efficient irrigation systems, modern fertilisers based largely on mining of chemical minerals, and agricultural machines such as tractors and combine harvesters, which themselves require numerous materials, particularly metals, drawn from the Earth for their construction.

Balanced against this ever growing harvesting of Earth resources, there are dangers for our fragile planet in careless exploitation and utilisation of those resources. The most immediate danger, as is now well known, is that associated with global warming and related climate change. Public, but above all political, awareness of the dangers associated with the changes in atmospheric chemistry due to the burning of fossil fuels and to other industrial processes has been slow to develop. The melting of the great ice sheets and the retreat of glaciers at an alarming rate is a matter of record, and the overwhelming majority of climate scientists are warning of the dangers of increased carbon dioxide and other greenhouse gases heating the surface of the Earth and leading to rising sea levels and extreme climatic excursions, whether storms or droughts. The generally inadequate response of governments to the threat of climate change seems partly due to an unwillingness to pay attention to bad news (especially when a very small minority of experts take an opposing view) and an unwillingness to take measures that relate to medium-to-long-term planning, i.e. extending beyond the three-, four- or five-year horizon associated with national elections.

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The wealth of our Earth resources is limited and our planet is fragile, or rather, the very thin layer extending from the top few metres of soil, or from the waters of seas and oceans, and up through the lower atmosphere – the so-called 'critical zone' – is fragile. People speak about 'saving the planet', but the Earth itself is not under threat, only what goes on in that critical zone and, in turn, the survival of a wide range of life forms, including *homo sapiens*. The use of the qualifier *sapiens*, from the Latin "wise", could prove an unfortunate irony.

But, humankind has long proved incredibly inventive and resourceful, and there is another form of wealth to add to that of our Earth's resources, that of human ingenuity. It may be that our financial systems face unprecedented challenges, but they are as nothing compared to the threat to our continued existence as a species. Great ingenuity will be needed to provide the resources for an Earth population of nine to ten billion people, or even more, and the expertise of Earth scientists (*sensu lato*) will have to play a central role. This will not only be in helping to develop new sources and types of raw materials and fuels, as well as systems and strategies to avoid irreparable damage to the Earth's critical zone, but also in persuading our governments to address these problems with even more urgency than they have devoted towards rescuing failed financial systems.

David J. Vaughan

(david.vaughan@manchester.ac.uk)

<sup>1</sup> David Vaughan was the principal editor in charge of this issue.