Highly Siderophile and Strongly Chalcophile Elements

in High-Temperature Geochemistry and Cosmochemistry

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FROM THE SERIES EDITOR

It has been a pleasure working with the two volume editors and authors on this 81st volume of *Reviews in Mineralogy and Geochemistry*. Several chapters have associated supplemental materials that can be found at the MSA website. Any future errata will also be posted there.

Ian P. Swainson, Series Editor
Vienna, Austria
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PREFACE

INTRODUCTION TO HIGHLY SIDEROPHILE AND STRONGLY CHALCOPHILE ELEMENTS IN HIGH TEMPERATURE GEOCHEMISTRY AND COSMOCHEMISTRY

In high-temperature geochemistry and cosmochemistry, highly siderophile and strongly chalophile elements can be defined as strongly preferring metal or sulfide, respectively, relative to silicate or oxide phases. The highly siderophile elements (HSE) comprise Re, Os, Ir, Ru, Pt, Rh, Pd, and Au and are defined by their extreme partitioning ($>10^4$) into the metallic phase, but will also strongly partition into sulfide phases, in the absence of metal. The HSE are highly refractory, as indicated by their high melting and condensation temperatures and were therefore concentrated in early accreted nebular materials. Within the HSE are the platinum-group elements (PGE), which include the six elements lying in the *d*-block of the periodic table (groups 8, 9, and 10, periods 5 and 6), i.e., Os, Ir, Ru, Pt, Rh and Pd. These six elements tend to exist in the metallic state, or bond with chalcogens (S, Se, Te) or pnictogens (P, As, Sb, Bi). Rhenium and Au do not necessarily behave as coherently as the PGE, due to their differing electronegativity and oxidation states. For these reasons, a clear definition between the discussion of the PGE and the HSE (PGE, Re and Au) exists in the literature, especially in economic geology, industrial, or bio-medical studies.

The strongly chalcophile elements can be considered to include S, Se, and Te. These three elements are distinguished from other chalcophile elements, such as Cd or Pb, because, like the HSE, they are all in very low abundances in the bulk silicate Earth (Fig. 1). By contrast with the

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