The Lu-Hf CHUR value

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Lu-Hf and Sm-Nd isotopic systems involve refractory and lithophile elements, so that the composition of Bulk Silicate Earth (BSE) should coincide with that of the Chondritic Uniform Reservoir (CHUR). BSE reference for Lu-Hf was first plotted within the terrestrial Hf-Nd isotopic array [1], and since 1997 lies just below it [2]. This raises questions of a possible hidden reservoir in the terrestrial mantle, or alternatively, a discrepancy with the CHUR parameters employed. Determination of CHUR Lu-Hf is hampered by the ~20% variation in Lu/Hf among the ordinary (OC) and carbonaceous chondrites (CC) analyzed previously [2-4], a contrast with Sm/Nd which varies by only ~3%. The Lu-Hf CHUR parameters were determined from a mean value for OC, mostly petrologic types 4 to 6, plus the two CC, Allende (CV3) and Murchison (CM2), and yielded ^{176}Lu/^{177}Hf = 0.0332 ± 2 and ^{176}Hf/^{177}Hf = 0.282772 ± 29 [2].

We analyzed 20 new chondrites for Lu-Hf and Sm-Nd isotope systematics. These included: (i) thirteen H, L, and LL OC of types 3.0 to 3.8, where their low degree of metamorphism limits the growth of phosphate (main carrier of REE) compared to the equilibrated types 4 to 6 OC; and (ii) seven CC of types 1 to 3 (CI, CV, CO and CK groups). We obtained mean values (2σ SE) of ^{176}Lu/^{177}Hf = 0.0337 ± 3, ^{176}Hf/^{177}Hf = 0.282802 ± 23, ^{147}Sm/^{144}Nd = 0.1961 ± 6, and ^{143}Nd/^{144}Nd = 0.512629 ± 16 from the types 1 to 3 OC (n=11) and CC (n=11) from this study (n=18) and [4] (n=4). These values are our best estimates for CHUR and BSE. The CC alone give higher mean values of ^{176}Lu/^{177}Hf = 0.0341 ± 4, ^{176}Hf/^{177}Hf = 0.282828 ± 38, ^{147}Sm/^{144}Nd = 0.1966 ± 10, and ^{143}Nd/^{144}Nd = 0.512639 ± 28. These last values are concordant with the Sm-Nd CHUR parameters that have been widely used since 1980 [5], but CC may not provide the best approximation for BSE.

The ^{176}Lu/^{177}Hf range obtained from all the types 1 to 3 CC and OC is now constrained to ~4%, similar to Sm/Nd. The mean values of ^{176}Lu/^{177}Hf and ^{176}Hf/^{177}Hf are higher than the previous estimates and reconcile the chondrite composition with the mantle array, removing any need for a hidden reservoir affecting Lu-Hf systematics. The ~20% range of Lu/Hf observed in type 4 to 6 chondrites must reflect metasomatic processes on the OC parent bodies associated with their thermal metamorphism.

References

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Mechanisms of phosphorus removal from waste waters: A novel basic oxygen steel slag treatment system

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Introdution

The novel use of Basic Oxygen Steel slag (BOS) has been identified for the removal of phosphorus from waste waters which is a primary concern for regulators (Drizo *et al*, 2002). BOS is a vesicular material, with high surface area and high pH generating potential (Ziemkiewicz, P., 1998), rendering it suitable for the remediation of phosphorus contaminated waters.

Discussion of Results

Batch experiments investigated phosphorus removal under varying environmental conditions (e.g. variation in pH and initial phosphorus concentration) using synthetic solutions. The effect of pH and initial phosphorus concentration proved to be the most significant of the factors tested with regard to phosphorus removal. Sorption mechanisms under controlled conditions will be discussed.

Column experiments were conducted to assess the removal of phosphorus solutions designed to simulate a range of problem waters, such as agricultural field drainage, secondary effluent from sewage treatment works and dairy parlour waste. The removal rates in the continuous flow reactors were correlated with influent concentration and hydraulic retention time. E-SEM, EDX and XRD analysis provided evidence of calcium phosphate precipitation and hence phosphate removal over a time series.

Conclusion

BOS is an effective remover of phosphorus from a range of waste waters under different environmental stresses and varying hydraulic regimes. Rarely in the literature have the means of phosphate sequestration been assessed in detail. The phosphate removal mechanisms together with the limitations to phosphate removal in the systems is discussed showing the temporal changes in calcium phosphate precipitate formation.

References

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