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Taylor S R. Abundance of chemical elements in the continental crust: a new table. *Geochim. Cosmochim. Acta* 28:1273-85, 1964.
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The uniform rare earth element pattern in sedimentary rocks was considered to represent the relative abundances of these elements in the continental crust and to be derived from mixing of equal proportions of acidic and basic igneous rocks. A new crustal abundance table was constructed on this basis, using the accurate data available from the granitic standard rock, G-1, and the basaltic standard rock, W-1. [The *SCI*® indicates that this paper has been cited in over 390 publications.]

Rare Earth Element Patterns and Crustal Composition

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The impulse to write this paper resulted from the problem of how to determine the composition of the continental crust of the Earth. Given the obvious complexity of the geology of the crust, the task might seem daunting, if not impossible. H.E. Suess and H.C. Urey[1] commented in 1956, "It is exceedingly difficult to estimate in any reliable way...the mean composition of the surface region of the Earth."

Such estimates are, however, necessary before we can make sensible calculations about the geochemical evolution of the Earth, particularly relating to the great enrichment (up to 30 percent of the total Earth budget) of many elements in the crust. Sampling and analysis of the multitude of units presently exposed can provide only surficial data. Nature, however, has already carried out the task, grinding up the surface rocks by erosion and depositing them as a variety of sediments. Although these are diverse, some of the more insoluble elements can carry the signature of their source rocks. The most important group are the rare earth elements (REE), significant in geochemistry not only on account of their uniformly varying ionic radii, but also because they may be transferred nearly quantitatively from the source rocks to the sedimentary record.

The key observation is that the REE abundance patterns for the 14 elements plus yttrium are remarkably uniform in sedimentary rocks. This fact became apparent with the advent of precise and accurate trace element analyses about 1960. The uniformity implies that nature is doing an excellent job of sampling and mixing the very diverse REE patterns in crustal igneous rocks, precisely the aim of geochemical sampling of the crust.

The REE patterns in the sediments provided the REE patterns of the upper crust. What about absolute abundances? When I pondered this question in 1964, the principal problem was that the database was very poor, and accurate values for many elements were available only for a few standard samples. In addition to the sampling problem, the question of reliable data existed for many elements. Analyses of the two famous original standard rock samples, granite G-1 and diabase (basalt) W-1, revealed just how many analytical problems existed; for many elements at that time, only the data for G-1 and W-1 could be considered reliable.

Granite and basalt are two of the major rock types in the crust. I calculated their appropriate mix to produce the uniform REE pattern observed in the sedimentary record. This ratio then enabled me to calculate the abundances of all the elements for which accurate data existed in G-1 and W-1. This represented a new approach to the problem of crustal abundance; hence, the title of the paper.

Curiously, the results have stood up remarkably well despite the very restricted database! Later extensive work on individual elements has generally resulted only in minor modifications.

Our work led to another question: Was the composition of the crust, so established, uniform, or did it vary with time? A major research effort extending over 15 years, studying the distribution of the REE in sedimentary rocks of varying ages throughout the geological record, culminated in a book on the composition and evolution of the continental crust[2] published with my coworker, Scott M. McLennan, in 1985. We established that a major break in crustal composition and evolution occurred between the Archean and Proterozoic. We also took the opportunity to publish a revised version of the abundances reported in the 1964 *Classic* paper.

1. **Suess H E & Urey H C.** Abundances of the elements. *Rev. Mod. Phys.* 28:53-74, 1956. (Cited 450 times.)
2. **Taylor S R & McLennan S M.** *The continental crust: its composition and evolution.* Oxford, England: Blackwell Scientific, 1985. 312 p. (Cited 55 times.)

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