Table 1. The thorium contents of manganese nodules from the Pacific Ocean.

Nodule	Latitude	Longitude	Depth (fathoms)	Thorium (ppm)
Horizon nodule	40°14′N	155°05′W	2790	124 ± 15
Cape Johnson Gyot	17°10′N	177°10′W	1055–1120	24 ± 5
Gulf of Alaska, sample 3	56°10′N	145°15′W		25 ± 2
Hess Guyot (manganese coatings on coquina shells of *Vermicularia*)	17°54′N	174°16′W	956–80	30 ± 6

of thorium in manganese nodules with respect to pelagic clays. Thorium in pelagic clays averages 5 ppm (*3*), whereas Matthews reports minimum thorium contents in three nodules of 30 to 40 ppm. Koczy (*4*) had previously observed higher values of thorium in the nodules than in clays with lower absolute values in both cases.

The following method was employed. Complete dissolution of approximately 1 g of the sample is accomplished by HCl-$HClO_4$, followed by a HF dissolution of the silica residue and a sodium carbonate fusion of any remaining solids. Thorium-234 is added to the combined solutions as a tracer for the determination of the yield. The thorium is then coprecipitated with $Fe(OH)_3$ upon addition of gaseous ammonia. The precipitate is dissolved in HF, and lanthanum carrier is added to precipitate LaF_3, which coprecipitates the thorium. This step is repeated to insure a complete separation of thorium from zirconium. The precipitate is dissolved in an aluminum nitrate-nitric acid solution, and the thorium is extracted into mesityl oxide (*5*). The thorium is stripped into water and extracted into a 2-thenoyltrifluoro acetone (TTA)-benzene mixture (*6*). The residue is then taken up in HCl and measured colorimetrically as the "thoron" complex of thorium (*7*).

The yields varied between 50 and 80 percent. Blank values on the reagents were less than 0.1 μg of thorium. The main interference in the colorimetric method comes from zirconium. Spectrographic analyses on the final residue from the TTA-benzene extraction revealed that the zirconium concentrations were below interfering levels.

The analyses of a number of Pacific Ocean manganese nodules are given in Table 1. Thorium is concentrated in manganese nodules by factors exceeding 5 over deep-sea sediments. This elemental enrichment of thorium closely parallels manganese. Such a result is not unexpected, since other elements, probably existing as cations in sea water, such as nickel, copper, and lead, show a similar behavior (*1, 8*). The unusually high thorium content of the Horizon nodule is anomalous. The thorium was not enriched either in the acid-insoluble residue or in the zeolite phases that form the core of the nodule and often accompany the manganese phases.

These preliminary results (*9*) lend support to the ionium-thorium method for the determination of the rates of accumulation of deep-sea sediments (*3*), since one of the major assumptions of this method is that ionium and thorium in the sediments are accumulated from sea water as opposed to volcanic or terrestrial sources.

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16 February 1955.

H. G. Wells Predicts

H. G. Wells scores again! From *The Fate of Man* (Longmans, Green, New York, 1939), p. 13:

> It is conceivable that the scientific worker is even now walking into a net; that increasing areas of his inquiries and experiments are falling under the restrictions of "official secrets" and that far beyond the more obvious realms of physics and chemistry, fields of investigation having no direct bearing upon warfare are likely to come under control.

We ain't seen nothin' yet!

BRUCE STEWART

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14 March 1955.