Diagenetic nature of Ir-anomalies: an alternative of impact hypothesis?

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At the different stratigraphic intervals of Phanerozoic sedimentary record of many areas, there are levels enriched by chemical elements, specifically iridium. The most interesting and intricate problem is the occurrence of Ir-anomaly at the K/T boundary. As it is widely known, this and Ir-anomalies at some other stratigraphic levels are mostly considered as a result of meteorite impact. Difficulty of its nature revelation is caused by low iridium concentrations in both embedded sediments and Ir-rich layer. We consider here possible causes of the formation of geochemical anomalies by the example of more large-scale processes where maturation of Ir-anomalies is a particular case.

In the Phanerozoic sedimentary record, there are prominent boundaries between TOC-rich sediments, most commonly clayey, and sediments lack in TOC, mainly sandstones, limestones, cherty rocks. In many cases, sulfide-rich beds correspond to these interfaces. Their thickness ranges from few cm to few dm and spatial extension reaches up to many tens or even hundreds km. Initially, sulfides in form of hydrotroilite $FeS \cdot nH_2O$, as well as Fe^{2+} and H_2S occurred in the strongly reduced conditions of TOC-rich clayey sediments. Later, they could penetrate into the near-contact zone under the influence of different factors (diffusion, transfer by interstitial water as a result of sediment compaction, gravitational, and electrochemical effects) where they precipitated forming a bed rich in disulfides (pyrite, a.o.). The cause of monosulfide to disulfide transformation is the higher oxygenation level of sulfur from pyrite than of sulfur from hydrotroilite. In other words, oxidizing agent, specifically oxygen, should be involved into the process of pyrite generation. That is why capable to migration jellous hydrotroilite turned into stable pyrite at the oxygen-bearing contact zone. Different elements including platinoids could be concentrated within formed by such a way sulfide-bearing beds.

A spectrum of conditions (Eh, pH, a.o.), which could promote migration of sulfides from reduced sediments and their precipitation at the geochemically contrasting boundaries, is rather wide. This process can occur at relatively low sediment enrichment in TOC. In this case, concentration of sulfides at the interface boundary is low also. Nevertheless, thin layers rich in a number of elements including iridium can be formed following this scenario.

This suggested mechanism of Ir-anomalies formation as a result of diagenetic processes allows the explanation of some their peculiarities which are inexplicable by impact hypothesis. I suggest that diagenetic sulfide migration and formation of geochemical anomalies of different scale are widely distributed at many stratigraphic levels, specifically, at the K/T boundary.

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