Meteorite impact, volcanism, and radiolarian faunal turnover recorded in the Upper Triassic of Japan

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The Late Triassic was characterized by several marine and terrestrial biotic turnover events prior to the end-Triassic mass extinction. The causes of the end-Triassic mass extinction and these Norian to Rhaetian biotic turnover events are still the subject of debate. Catastrophic processes such as widespread eruption of the Central Atlantic Magmatic Province (CAMP) flood basalts and extraterrestrial impacts have been proposed to account for the biotic turnover events [1, 2]. Here, we report a marine osmium (Os) isotope record reconstructed from an Upper Triassic bedded chert succession in Japan, which accumulated on the paleo-Pacific deep seafloor. We also analyzed the extinction patterns of Late Triassic radiolarian species from the bedded chert succession with the marine Os isotope record.

The Os isotope data show an abrupt and marked negative excursion from an initial Os isotope ratio of ~0.477 to unradiogenic values of ~0.127 in a claystone layer within a middle Norian bedded chert (~215 Ma), indicating the input of meteorite-derived Os into seawater [3]. A gradual decrease in $^{187}Os/^{188}Os$ ratio during the Rhaetian (201–210 Ma) is considered to have been closely linked to the CAMP volcanic event [4]. An analysis of radiolarians provides no indication of a mass extinction event across the claystone layer and during the CAMP volcanic phase. However, a significant faunal turnover occurred at ~1 Myr after the impact event. Biostratigraphic analysis shows that 20 radiolarian species became extinct at this level in the chert. It is possible that the impact triggered the extinction of these 20 species, though the direct cause of their extinction remains uncertain.

[1] Marzoli et al. (1999) Science 284, 616-618. [2] Spray et al. (1998) Nature 392, 171-173. [3] Sato et al. (2013) MinMag, this volume. [4] Kuroda et al. (2010) Geology 38, 1095-1098.

The influence the stoichiometry of arsenopyrite on the impurity density

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The chemical composition of arsenopyrite FeAsS may differ in detail from one deposit to another, from one deposition stage to another in a given deposit, and even from the outer parts of a single grain towards its interior. Based on a comprehensive analysis of the crystal structure, chemical and phase composition of the analytical expressions for the calculation of the impurity density in the arsenopyrite received. The algorithm for calculating the impurity density structures such as NiAs proposed Onufrienok (Onufrienok et al., 2012). To calculate the density impurities into arsenopyrite was amended. The impurity density for the impurity atoms cobalt Co, copper Cu, nickel Ni and gold Au is calculated separately. Specimens for investigated from the deposit Panimba Krasnoyarsk region. Studies have been conducted on ~65 samples from different mines. One such series is presented in Table 1

(S/Fe) + (As/Fe)	cobalt Co		nickel Ni		copper Cu		gold Au	
	α, %	β, $\square 10^{-2}$	α, %	β, $\square 10^{-2}$	α, %	β, $\square 10^{-3}$	α, %	β, $\square 10^{-3}$
1.9627	0.16	0.547	0.021	0.069	-	-	0.002	0.026
1.9467	0.18	0.613	-	-	0.007	0.216	0.061	0.792
1.9328	0.30	0.996	0.076	0.251	-	-	0.011	0.142
1.9690	0.18	0.621	0.006	0.019	-	-	0.045	0.592
1.9552	0.17	0.578	0.012	0.039	0.014	0,433	0.007	0.091
1.9866	0.83	2.746	0.016	0.053	0.058	1.795	0.008	0.105
1.9646	0.52	1.716	-	-	0.019	0.588	0.040	0.521
2.0020	0.51	1.694	0.436	1.444	0.017	0.527	0.027	0.361
2.0106	0.25	0.832	0.328	1.086	-	-	-	-
2.0157	0.28	0.954	0.209	0.692	-	-	-	-
2.0340	0.45	1.490	-	-	0.013	0.403	0.010	0.136

Table 1: Results of the microprobe analysis (α) and the results calculations of the density impurity (β) into the arsenopyrite.

Because of the large scatter of the experimental points should speak not about dependencies but only a trend. As it is shown in the table, tendency to increasing of the density impurities with increasing nonstoichiometry is installed. Stoichiometric composition should be considered when the ratio (As + S)/Fe is equal to two. Decreasing this ratio impurity density tends to decrease. Statistical analysis of all samples (~65) confirmed the findings.

[1] Onufrienok et al., (2012): Proceedings of the 10th International Congress for Applied Mineralogy, 487-495