

# SUPPLEMENTARY MATERIALS

## Comparative Study of Sample-Preparation Techniques for Quantitative Analysis of the Mineral Composition of Humic Substances by Inductively Coupled Plasma Atomic Emission Spectroscopy

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**Figure S1.** The content of elements ( $\text{mg kg}^{-1}$ ) by different types of sample preparation approaches for “Powhumus”, “Sakhalin”, and “Life Force” HS: an aqueous colloidal solution of HS (Direct), fusion with  $\text{LiBO}_2$  (Ashing), an aqueous colloidal solution of HS followed by centrifugation (Centr), treatment with boiling nitric acid (Acid), treatment with nitric acid at 250 °C using a microwave autoclave (MW acid): As (*a*); B (*b*); Ba (*c*); Be (*d*); Cd (*e*); and Co (*f*).

**Figure S2.** The content of elements ( $\text{mg kg}^{-1}$ ) by different types of sample preparation approaches for “Powhumus”, “Sakhalin”, and “Life Force” HS: an aqueous colloidal solution of HS (Direct), fusion with  $\text{LiBO}_2$  (Ashing), an aqueous colloidal solution of HS followed by centrifugation (Centr), treatment with boiling nitric acid (Acid), treatment with nitric acid at 250 °C using a microwave autoclave (MW acid): Cr (*a*); Cu (*b*); Li (*c*); Mn (*d*); Mo (*e*); and Ni (*f*).

**Figure S3.** The content of elements ( $\text{mg kg}^{-1}$ ) by different types of sample preparation approaches for “Powhumus”, “Sakhalin”, and “Life Force” HS: an aqueous colloidal solution of HS (Direct), fusion with  $\text{LiBO}_2$  (Ashing), an aqueous colloidal solution of HS followed by centrifugation (Centr), treatment with boiling nitric acid (Acid), treatment with nitric acid at 250 °C using a microwave autoclave (MW acid): Pb (*a*); Sn (*b*); Sr (*c*); V (*d*); W (*e*); and Zn (*f*).

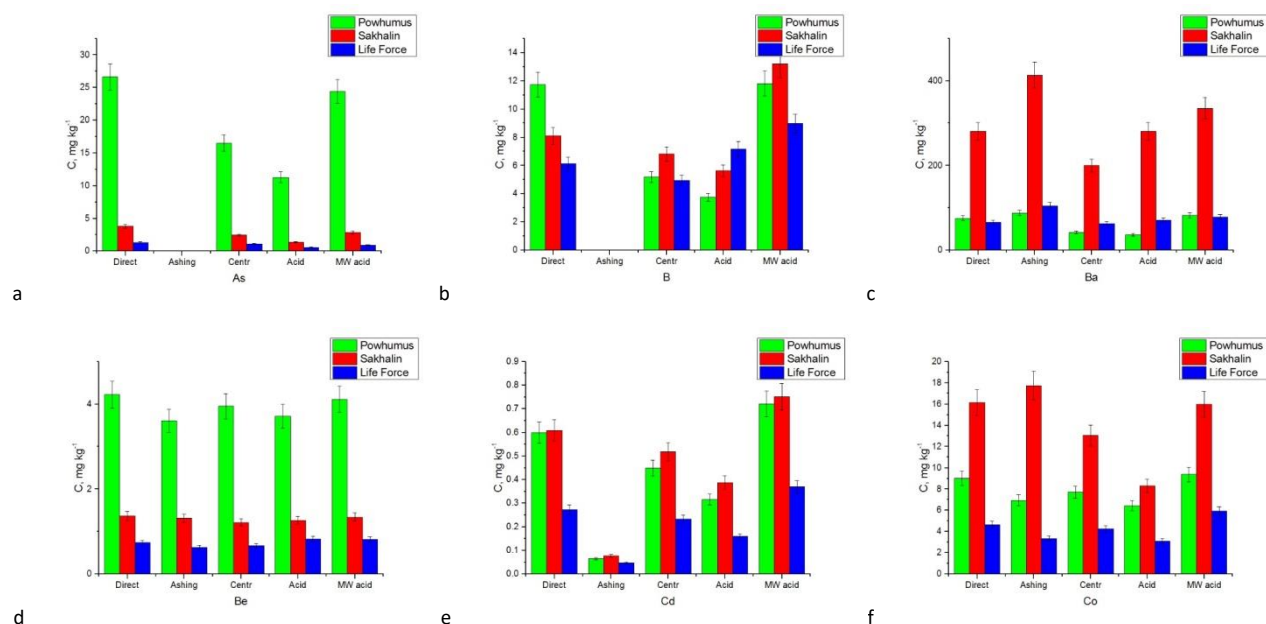
**Figure S4.** The content of elements ( $\text{g kg}^{-1}$ ) by different types of sample preparation approaches for “Powhumus”, “Sakhalin”, and “Life Force”: an aqueous colloidal solution of HS (Direct), fusion with  $\text{LiBO}_2$  (Ashing), an aqueous colloidal solution of HS followed by centrifugation (Centr), treatment with boiling nitric acid (Acid), treatment with nitric acid at 250 °C using a microwave autoclave (MW acid): Al (*a*); Ca (*b*); Fe (*c*); Mg (*d*); S (*e*); Si (*f*); and Ti (*e*).

**Figure S5.** The content of elements ( $\text{g kg}^{-1}$ ) by different types of sample preparation approaches for “Powhumus”, “Sakhalin”, and “Life Force”: an aqueous colloidal solution of HS (Direct), fusion with  $\text{LiBO}_2$  (Ashing), an aqueous colloidal solution of HS followed by centrifugation (Centr), treatment with boiling nitric acid (Acid), treatment with nitric acid at 250 °C using a microwave autoclave (MW acid): K (*a*); Na (*b*); and P (*c*). Y-axis is in a log format.

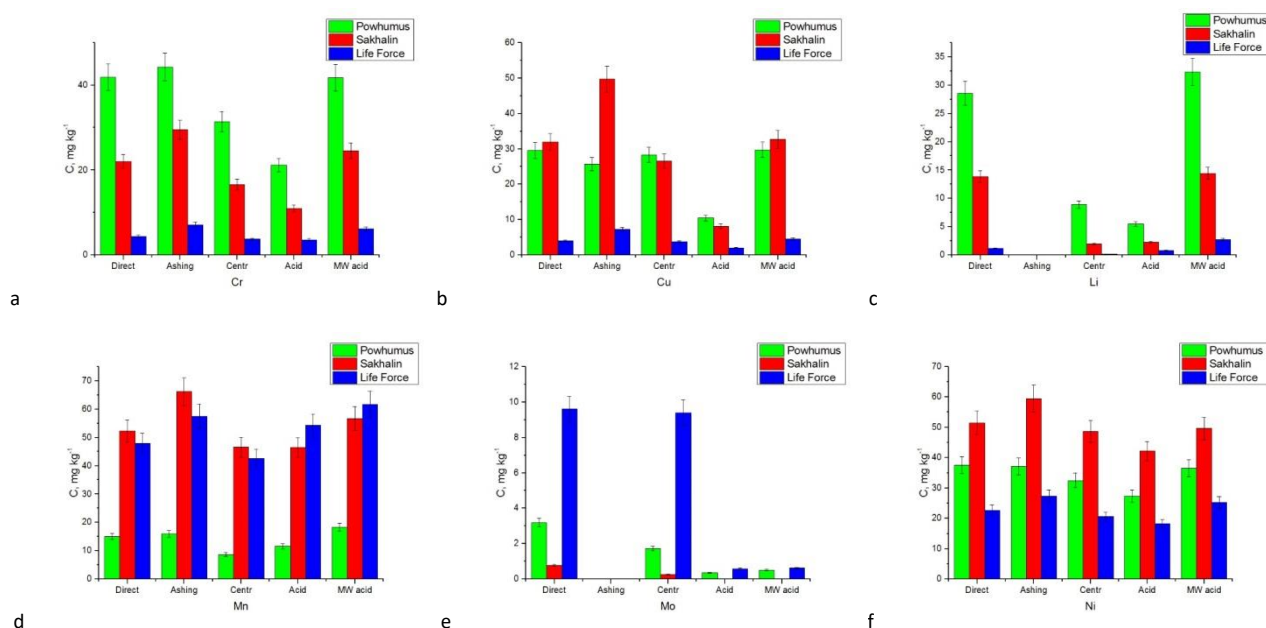
**Figure S6.** The content of major (*a*) and minor (*b*) elements (in oxide forms) in the “Powhumus” HS sample. The total content of minor elements shown in diagram *b* is 0.4% of the sample.

**Figure S7.** The content of major (*a*) and minor (*b*) elements (in oxide forms) in the “Sakhalin” HS sample. The total content of minor elements shown in diagram *b* is 0.3% of the sample.

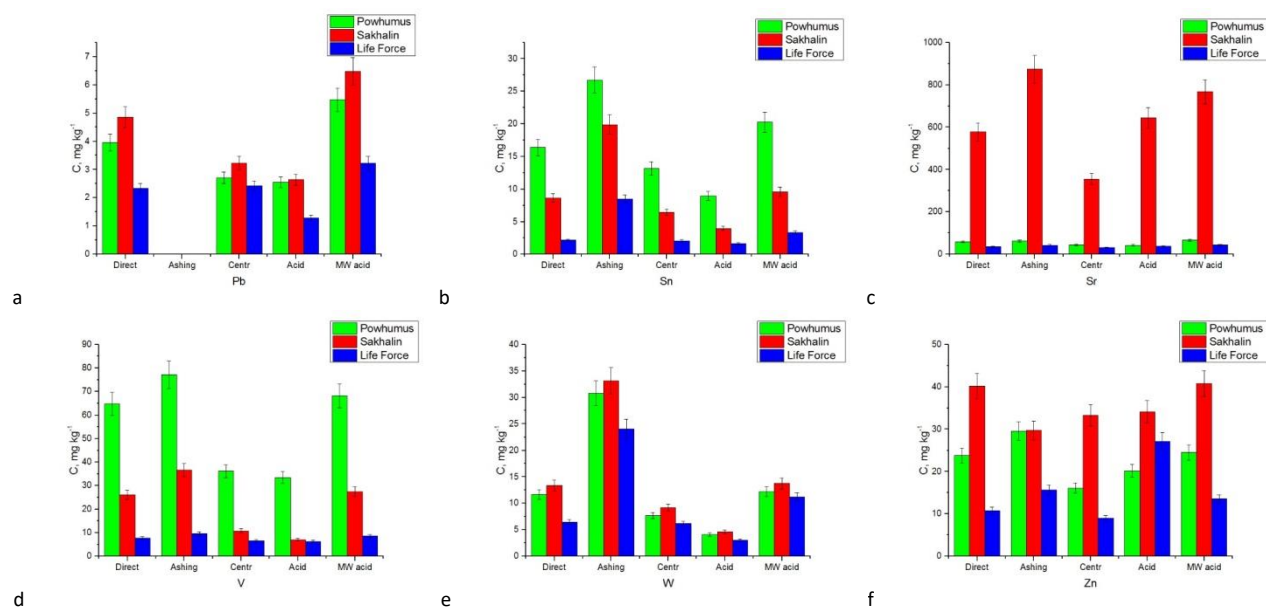
**Figure S8.** The content of major (*a*) and minor (*b*) elements (in oxide forms) in the “Life Force” HS sample. The total content of minor elements shown in diagram *b* is 0.3% of the sample.



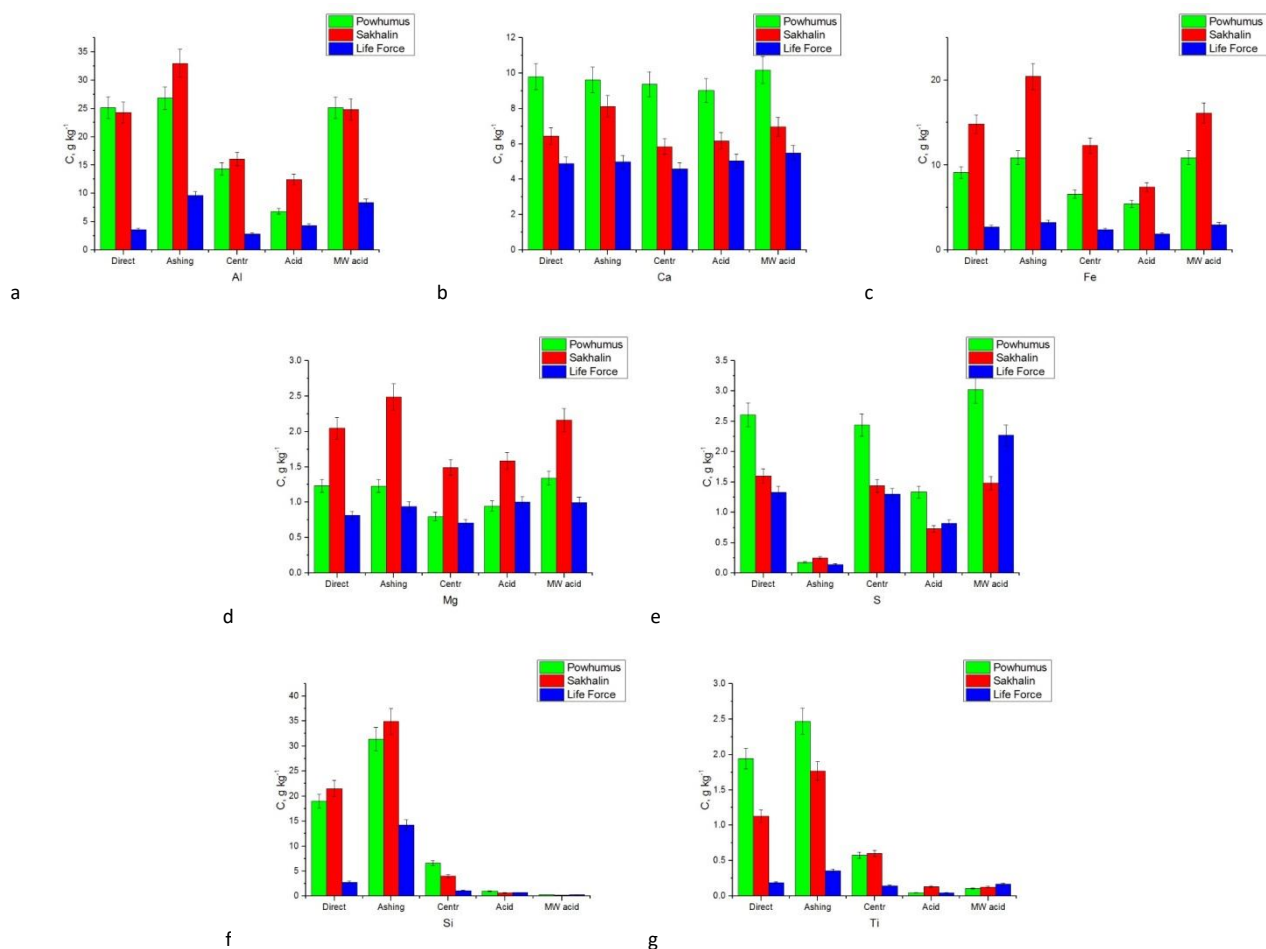
**Figure S1.** The content of elements (mg kg<sup>-1</sup>) by different types of sample preparation approaches for “Powhumus”, “Sakhalin”, and “Life Force” HS: an aqueous colloidal solution of HS (Direct), fusion with LiBO<sub>2</sub> (Ashing), an aqueous colloidal solution of HS followed by centrifugation (Centr), treatment with boiling nitric acid (Acid), treatment with nitric acid at 250 °C using a microwave autoclave (MW acid): As (a); B (b); Ba (c); Be (d); Cd (e); and Co (f).



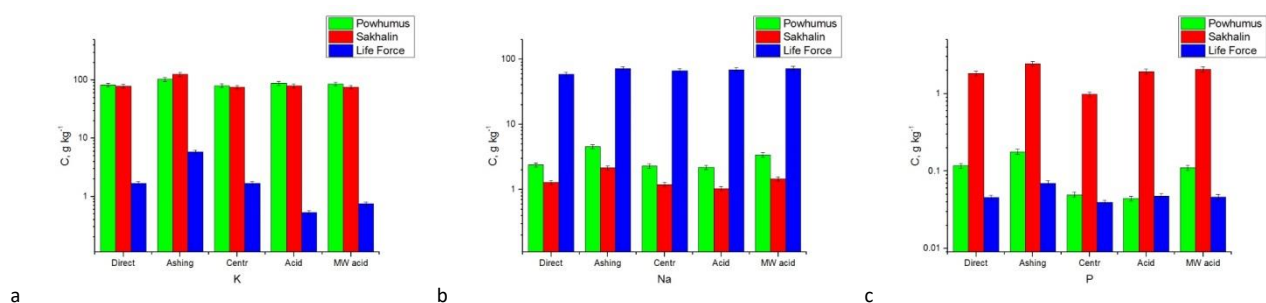
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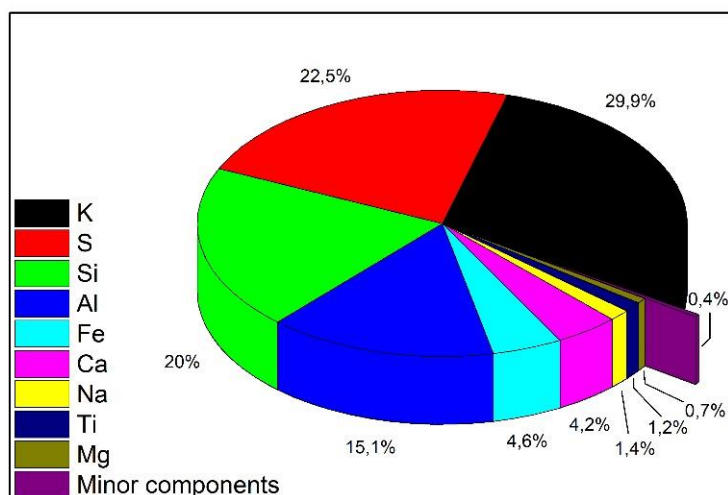
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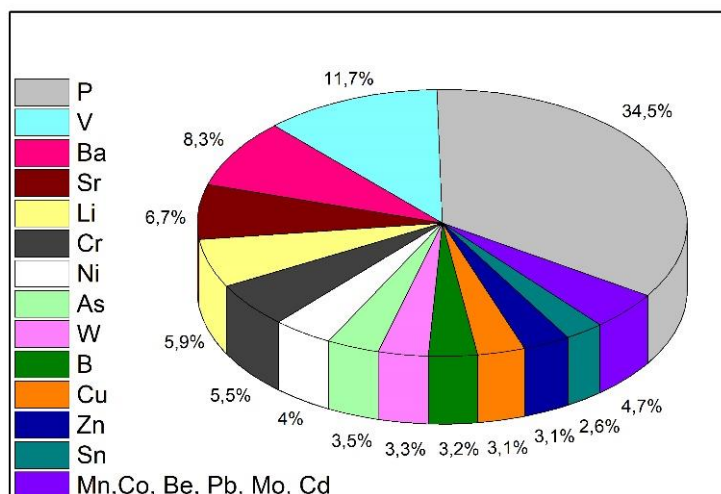
**Figure S4.** The content of elements (g kg<sup>-1</sup>) by different types of sample preparation approaches for “Powhumus”, “Sakhalin”, and “Life Force”: an aqueous colloidal solution of HS (Direct), fusion with LiBO<sub>2</sub> (Ashing), an aqueous colloidal solution of HS followed by centrifugation (Centr), treatment with boiling nitric acid (Acid), treatment with nitric acid at 250 °C using a microwave autoclave (MW acid): Al (a); Ca (b); Fe (c); Mg (d); S (e); Si (f); and Ti (e)



**Figure S5.** The content of elements (g kg<sup>-1</sup>) by different types of sample preparation approaches for “Powhumus”, “Sakhalin”, and “Life Force”: an aqueous colloidal solution of HS (Direct), fusion with LiBO<sub>2</sub> (Ashing), an aqueous colloidal solution of HS followed by centrifugation (Centr), treatment with boiling nitric acid (Acid), treatment with nitric acid at 250 °C using a microwave autoclave (MW acid): K (a); Na (b); and P (c). Y-axis is in a log format.

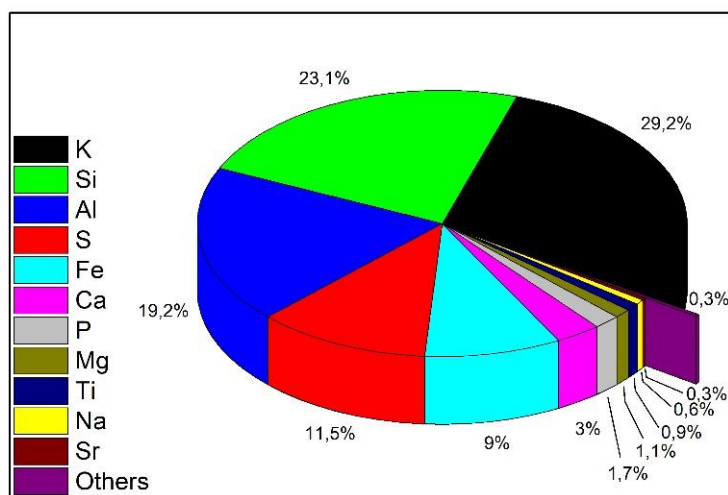


*a*

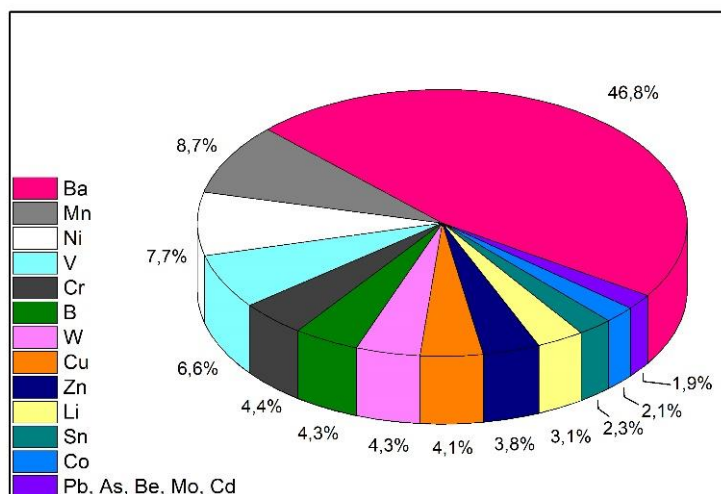


*b*

**Figure S6.** The content of major (*a*) and minor (*b*) elements (in oxide forms) in the “Powhumus” HS sample. The total content of minor elements shown in diagram *b* is 0.4% of the sample.

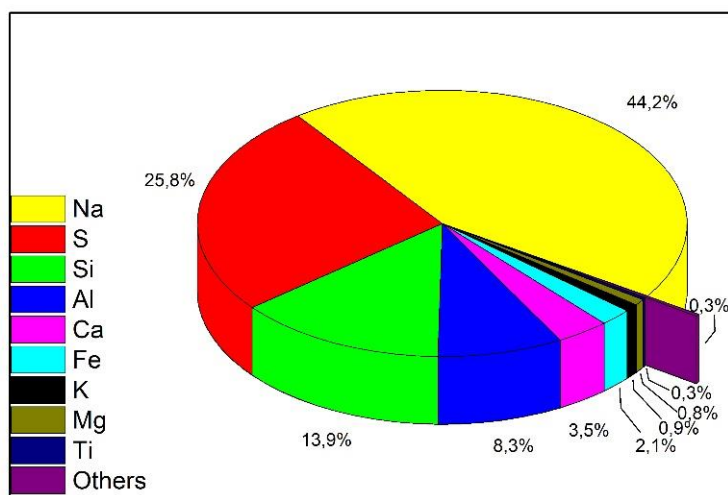


*a*

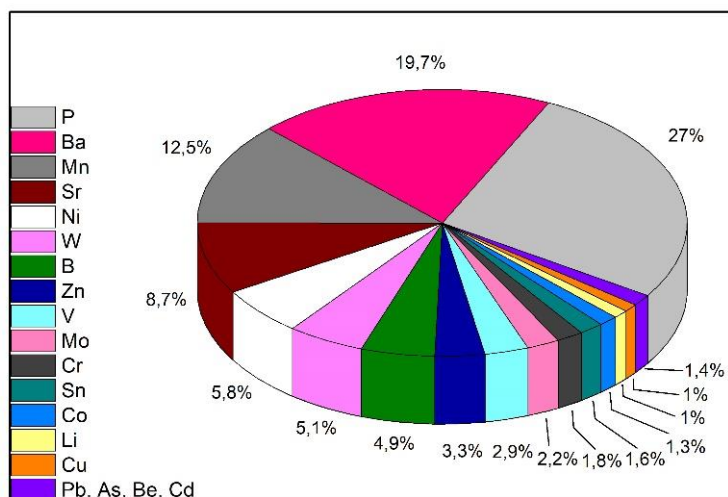


*b*

**Figure S7.** The content of major (*a*) and minor (*b*) elements (in oxide forms) in the “Sakhalin” HS sample. The total content of minor elements shown in diagram *b* is 0.3% of the sample.



*a*



*b*

**Figure S8.** The content of major (*a*) and minor (*b*) elements (in oxide forms) in the “Life Force” HS sample. The total content of minor elements shown in diagram *b* is 0.3% of the sample.