The stable isotope and chemical composition of pedogenic carbonate in the Minusinsk Basin, South Siberia

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1. Introduction
Pedogenic carbonates are often used in paleoenvironmental reconstructions [2–5]. Carbon isotope composition may provide the information on CO₂ concentrations [2, 4] and dominant vegetation while the carbonate formation [4,6,8]. Oxygen isotope composition of carbonates refer to the temperature of their formation [6] through the direct positive correlation between air temperature and precipitation [6] and, consequently, soil water. We studied stable isotope composition and chemical composition of pedogenic carbonates as reliable records of paleoenvironmental data widespread in South Siberia.

2. Study area
Fig. 1. Study sites in Minusinsk Basin: 1. Minusinsk basin; 2. North Minusinsk Basin ([Upper paleolacustrine]); 3. Al-Khald Lake basin (Altay Mountains) [5]; 4. Ak-Khald Lake basin (Altay Mountains) [5]; 5. Southern Ca-Toba (Altay) [7].

3. Methods
Carbonate coatings were sampled from pits and exposures (Fig. 4A, C). Soil pore water was extracted by ethanol (Fig. 4B). Soil and vegetation samples were taken from every pit. Organic carbon and CaCO₃ content in soil was measured. Buried soil horizons were 1°C heated (conventional method), dates were calibrated in OxCal (IntCal13). Isotope composition was measured by Delta V+ mass spectrometer (Fig. 4D). Major and minor element content was measured by ICP-MS (Fig. 4E).

4. Results
Fig. 4. Research methods.

5. Conclusions
The stable isotope and chemical composition of carbonate rocks (A) and their neoformations (B) are the main indicators of local environmental changes. Differences in stable isotope composition and chemical composition of carbonate coatings are a result of the local environmental conditions. The concentration of elements in sediments and soils is significantly lower than in carbonate rocks (A). The stable isotope composition of soil water is significantly lower than in the contemporaneous precipitation. The δ¹³C value of soil water was 20‰, while for precipitation was 23‰.

Key References

Table 1. Comparison of stable isotope composition and age of carbonates of different parts of South Siberia.

Table 2. Estimated soil-derived composition of total C in δ¹³C (‰) through carbonates of different age.

Table 3. Median value content of elements in coatings (% in comparison to natural abundance of elements in carbonate rocks (A) and soil coatings (B)).