

THE TEMPORAL DYNAMICS OF LITHOGENIC AND PEDOGENIC CARBONATES IN RUSSIAN SOILS DURING THE LATE HOLOCENE AND THEIR ROLE AS A BUFFER RESERVOIR FOR ATMOSPHERIC CO₂.

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The investigation of temporal carbonate dynamics for historical time was carried out. The 350 paleosoil profiles of different ages were studied. We compared them with the modern soils. The content and store of the carbonates for 0-2 m layer were determined and averaged for each soil type. Then the result was extrapolated for whole area of soil type, the change of carbonate store (dynamics) was calculated and accumulation (sink) and release of CO₂ was evaluated for the soil-geographical zone. We studied 30 soil chronosequences: for chernozem (4 chronosequences), calcic castanozem (4 chronosequences), castanozem ordinary (9 chronosequences) and gypsic castanozem (5 chronosequences). The other zones were represented by 1-3 soil chronosequences. All soil types being important for dynamics of CO₂ were studied. Carbonate store dynamics changes essential for each soil chronosequence. The difference between mean weighted content of CaCO₃ was characterized mostly by negative values. It occurred due to dynamics of environment factors and changes of soil conditions. During the last 3500 years the main tendency was the decrease of soil carbonate store. Its percentage ranged from 0 to -3%. Maximal carbonate loss from soils was due to high atmospheric precipitation and rather big initial content of carbonates. Mean value of CO₂ loss from Russian soils during the last 3500 years was 130 kg·m⁻² (0.037 kg·m⁻² per year). The annual CO₂ loss ranges from 4200 to 107 kg·m⁻² (south taiga zone) to 0 (dry steppe zone). The summarized value for whole Russia is about 1.3 Pg. The study of carbon isotopic composition of soil carbonates and humus shows that in all studied soil carbonates are represented both by lithogenic fragments and by pedogenic carbonates. The carbon isotopic composition of studied soil humus and carbonates ranges from -20.8 to -24.4 ‰ and from -2.8 to -8.7 ‰ respectively. It is possible to determine the content of pedogenic carbonates on the carbon isotopic composition of soil humus and carbonate. The content of pedogenic carbonate depends on the soil type and soil age, and on the parent material. The temporal pedogenic carbonate dynamics shows that during the historical time two epochs of carbonate accumulation were observed, during arid epochs about 4000-3500 and 2300 years ago. The general carbonates, as was shown by our investigation, are leached from profile and enter the carbon cycle as bicarbonate. The dissolving lithogenic carbonates served as a source of Ca ion for formation of pedogenic carbonates. These processes might occur in parallel. The dissolution of general carbonates occurs in early spring, but the formation of pedogenic ones occurs in the summer. Thus, pedogenic carbonates were accumulated during the soil formation, in spite of the leaching of general carbonates. The leaching of general carbonate (as CO₂) during the last 3500 years reached in chernozems 46 kg·m⁻², calcic castanozems 57 kg·m⁻² and gypsic castanozems 77 kg·m⁻². In the same time the accumulation of pedogenic carbonates occurred respectively 6.6; 3.4 and 2.6 kg·m⁻². Thus, the leaching of general carbonates was much more than pedogenic carbonate accumulation, and so the whole Russian soils (342282 thousand ha) served as an additional source of CO₂, in spite of binding of CO₂ by pedogenic carbonates.