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# Changes of weathering processes of rock building materials in urban environments during the Anthropocene

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Intense weathering of rock building materials in polluted urban atmosphere was studied in the second half of XX century in numerous localities, mostly in towns rich in historical monuments. Weathering was related to high concentration of pollutants in the atmosphere and in meteoric precipitation. The occurrence of black gypsum crust on surface of rocks exposed to wet and dry deposition was a typical feature of weathering. Black gypsum crust was typical of surface not subject to direct rainwater washing whereas surface intensively washed was devoid of gypsum crust. High concentration of sulphate and calcium ions in rainwater and the reaction of atmospheric sulfur components with calcite present in the rock was responsible for formation of the gypsum crust. Salt weathering related to intense crystallization of gypsum and minor amounts of other salts on the rock surface and pore spaces in the outer layer of the rock resulted in significant granular disintegration, blistering, scaling of building materials and rock decay.

A study of Krakow's weathering zones over a 40-year period gives us an opportunity to present a change of weathering processes. The difference is related to significantly lower content of pollutants in the atmosphere and changes in proportions of major pollutants (e.g., decrease in concentration of $SO_2$ from values between 80 and 90 microgram/$m^3$ to below 10 microgram/$m^3$ and of PM10 by 50% during last 40-45 years).

In recently collected samples of black crust some secondary voids appear in gypsum crystals most likely due to dissolution by rainwater with low content of dissolved compounds. In the recently developed zone on the "old" gypsum crust irregular calcium carbonate forms are common together with dust particles (both natural and anthropogenic). In sections through outer zone of black crust is possible to note predominance of dust particles and calcite over gypsum which is related to low rate of gypsum crust formation.

Salt weathering in urban and industrial centres which was considered to be very important in rock building material decay in XX century is now very limited in importance or even absent.