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Tracing the Anthropocene bomb-spike in urban strata of Vienna

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Urban anthropogenic strata forms the layered archaeosphere in the underground of large cities. In a transdisciplinary project involving geosciences, isotope physics and urban archaeology, funded by the Vienna Science and Technology Fund (WWTF), we looked for artificial isotopes in urban layers around the proposed starting date of the Anthropocene in the middle of the 20th century. The tested archaeological site is situated in the heart of Vienna, in a park area at Karlsplatz, adjacent to the renovated Vienna Museum. Excellent and detailed 3D archaeological stratigraphy sets age constraints around 1922, post-1945, and around the 1960s. A layer on top of the WWII rubble that fills fundamentals of a 1922 building post-dates 1945, and pre-dates the finishing shaping of the human-made park ground of 1959, the date of the opening of the Vienna Museum. We focused on the fine-grained (clayey-sandy) sediment matrix on top of the WWII rubble, at the base of and mixed with backfilled soil material. The sieved fraction below 2 mm grain size was dried and pulverised. This sediment sample was prepared for chemical separation of actinides which were then analysed by Accelerator Mass Spectrometry (AMS) using the setup at the Vienna Environmental Research Accelerator (VERA, Isotope Physics Group). We identified several artificial radionuclides including U-236, Np-237, Pu-239, Pu-240. Isotope ratios like Pu-240/Pu-239 and in particular U-233/U-236, which was only recently introduced as anthropogenic tracer by the VERA group, clearly point to atmospheric atomic bomb fallout material of the 1950s to 1960s. A significant input of Chernobyl (1986) material can be excluded based on the ratio Pu-241/Pu-239. Thus, the 1952-1964 bomb-spike as the possible primary (GSSP) marker of the Anthropocene can be identified and used even in coarse urban anthropogenic sediments of big cities, exemplifying the correlation potential of these radionuclide markers.