

Platinum trajectories in two major French rivers using dated sediment cores (1930-2021): From geochemical baseline to emerging source signals

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Platinum (Pt) is a Technology Critical Element (TCE) used in various applications because of its catalytic and medical properties. Since the 1990s, Pt has been mainly used in the automobile industry in catalytic converters to reduce emission of toxic gases by vehicles. Previous studies have shown Pt contamination of road-side sediments and surface sediments in urban rivers and lakes in Northern America and Europe. However, very few studies are reported on historical records of Pt concentrations in fluvial sediment. In order to analyze temporal variations (trajectories) of Pt over the last decades, sediment cores were collected in floodplains or in secondary channel at the downstream part of two major French watersheds (Loire and Seine rivers) and dated using ¹³⁷Cs records, from the mid-1930s to 2021. Platinum was analyzed by Adsorptive Cathodic Stripping Voltammetry (Ad-CSV) at ultra-trace levels (LOD = 0.01 ng L⁻¹). Platinum baseline levels in the sediment were estimated for the Loire River (0.88±0.35 µg kg⁻¹), but not for the Seine River because of historical fluctuations (up to 12.7 µg kg⁻¹). Temporal Pt variations in the Loire River sediments seem to reflect the hydrodynamic changes of the river. The relatively high historical Pt levels in the Seine River sediments suggest various anthropogenic sources, from coal burning to petrochemical and industrial activities in the watershed. Since the early 2000s, Pt concentrations in the Loire River sediments have risen, reaching to 2.45 µg kg⁻¹ at the top of the core. This increase was attributed to the use of vehicle catalytic converters, representing an emerging Pt source since the 1990s. The Pt record in the Loire River suggests that the response in sediments may be delayed by 10 to 15 years which could reflect the time needed to (i) consider the sedimentary cascade from soil erosion to sediment transport in river and (ii) have sufficient Pt emission by an increasing number of vehicles equipped with Pt catalytic converters. The present comparison of temporal Pt evolution in contrasting hydrosystems allowed to distinguish signals