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Long-term impact of pesticides use on vineyard

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Worldwide increase of pesticides uses in agriculture has been growing over the past decades but their long-term fate and effects on environment and ecosystem are poorly understood. Here, we present a retro-observation approach based on lake sediment record to monitor micropollutants and to evaluate the long term impact of pesticides treatments on a vineyard catchment in Savoie (France). In this study, we combined sedimentological and geochemical analyses to reconstruct the recent history of wine practices. The sediment sequence chronology, based on short-live radionuclides (210Pb/137Cs), provides a well constrain continuous age–depth relationship covering to the last century.

Over this period, we reconstruct the succession of fungicides, insecticides and herbicides in relation to the appearance of new chemical substances and the banning of old ones. The first use of fungicide began at the end of the 19th century with the Bordeaux mixture (Cu). After the World War II, we observed an intensification of fungicides treatment against mildew, powdery mildew, Botrytis fungi and black rot with specific molecules succession. Insecticides used in vineyard treatment against tetranychid and eriophyid mites were observed since 1940 with a main increase in 1970. Dicofol, Bromopropylate, Bifenthrin succeed to DDT banning in 1972, but a secondary source of DDT appeared at the early of 90's. The first herbicides use was observed between 1960 and 1970 with the presence of Triazine metabolite (pre-emergence herbicide) and high value of AMPA (Glyphosate metabolite, Roundup®), used as post-emergence herbicide, were found since 1990.

Two sedimentation rate increases in 1973 and 1994 could be directly assigned to wine practices. In early 70's, heavy farm machinery associated to the first application of pre-emergence herbicide, induced a first increase of soil erosion. In early 90's, post-emergence herbicide (Roundup®) treatment had a stronger impact on soil erosion with a huge contaminated sediment export. This latter, associated with high AMPA flux, is synchronous to the re-emergence of banned pesticides with the new source of DDT and its aerobic metabolites (DDE) probably stocked in vineyard soil. Over the last years, the decrease of pesticides concentration may be probably related to French and European policies against micropollutant substances in agriculture.