Regional geochemical mapping: An ideal teaching tool to demonstrate the imprint of the subsurface on the surface environment

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Geochemical surveys map the distribution of elements in natural materials to obtain information on, for example, bedrock geology, mineralisations, nutrient availability, pollution and provenance. They illustrate how the subsurface geosphere interacts with the Earth's surface, which holds great potential in geoscience teaching.

Here, we present results of regional geochemical mapping fieldwork carried out by undergraduate students in the Pallaresa basin of Northern Spain, and the Allier River valley in the Massif Central, France from 1998 to 2018. Students systematically collected water and sediment samples from 1st and 2nd order streams, measured the pH, EC and temperature, and recorded field observations including discharge, local geology, type of river, sediment colour, and any disturbances to the site. Water samples were analysed in a field laboratory for Ca, Na, K, and Fe by flame-AAS, SO_4 by turbidity, and F by colorimetry or ISE. Sediment samples were dried, sieved, and the clay fraction either leached by 1:1 hot HCl and analysed by flame-AAS, or directly analysed by micro-benchtop powder XRF. Results were presented to students as histograms, correlation matrices, and spatially as bubble plots overlain over simplified geological maps. In both field sites, a clear imprint of the bedrock geology on water and sediment compositions is observed, locally overprinted by disturbances from towns and past mining activity.

Our regional geochemical surveying familiarises students with sampling and analysis of geological materials, and interpretation of their compositions in terms of bedrock geology, geomorphology and human-induced distrubances in a hands-on approach that enforces the learning goals. It highlights the complementary nature of the various geoscience fields and shows students the value, and need of inter-disciplinarity.