Evaluation of the impact of quarrying activities on PM concentration and chemical composition: First results of the EMCAIR project

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Although Air Quality in Europe has significantly improved since 2000, some large discrepancies are still observed across the EU members. As a result, pollution episodes with Particulate Matter (PM) concentrations above EU limit values remain important at some locations and need to be better characterized in order to define more efficient local abatement strategies.
Mineral dust is an important component of PM_{10}, responsible for many PM exceedances, especially over Southern Europe. It can originate from both natural (soil resuspension) and anthropogenic emissions (non-exhaust traffic, building, quarries, etc). While addressing the influence of dust in PM levels in Europe, it remains unclear whether specific emissions like quarrying activities have an important impact on local PM concentrations and how these activities can be discriminated from natural dust. Although these emissions are taken into account in emission inventories, still few studies are available so far to constrain emission factors from quarries and evaluate their local impact on PM concentrations and composition.

The EMCAIR project (Emission for quarries in the air) aims to improve our understanding of the impact of quarrying activities on local air quality with a focus on PM in various contexts (geological, climatic,..). It will better characterize PM properties emitted from quarries (size distribution, chemical composition) against background dust, and evaluate the impact of these emissions at local scale (downwind area). Ultimately, EMCAIR will develop and validate an experimental protocol that may be widely applicable to characterize the impact of quarrying emissions.

As part of the EMCAIR project, a 1-month field campaign, which is in charge atmo Nord- Pas-de-Calais, has been performed in Northern France at 5 different locations impacted by quarrying activities (two inside the quarries and 3 outside; see Figure 1). Filter (Partisol) and (3-stage) cascade impactor samples were collected at the different sites in order to perform a detailed chemical analysis of PM (ions, carbon, trace elements). This experimental setting was completed by a large suite of on-line ($PM_{2.5}$, PM_{10}) and off-line (Owen Gauge) measurements in order to better describe the short-term PM variability and dry/wet dust deposition mass and composition.

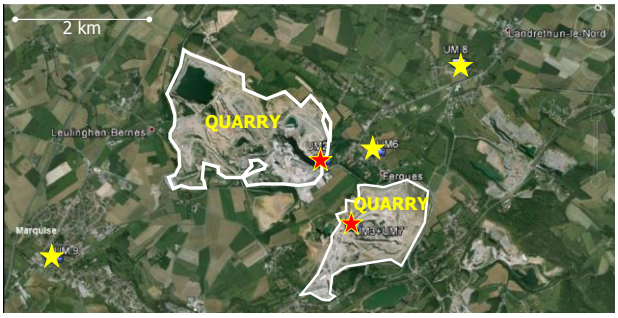

Figure 1: Location of the sampling sites inside/outside the quarries, Nord-Pas-de-Calais region, France.

We present here the experimental results of this first field campaign of the EMCAIR project from the first quarries in a limestone basin in North of France. The chemical fingerprint of the quarry's emissions was characterized here from air (PM_{10}) samples, soil collections and wet/dry deposition. The influence of the quarrying activities on PM concentration/composition at receptor sites was then investigated here using size-resolved chemistry.

Our preliminary results suggested that quarry's influence remains limited in their vicinity as illustrated in Figure 2 for calcium which is a major component extracted from the quarries.

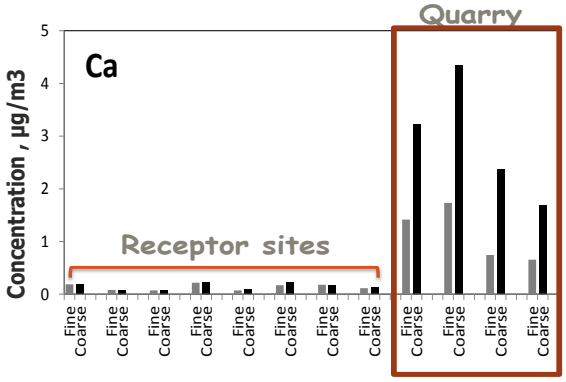

Figure 2: Weekly averaged concentration of calcium in fine ($PM_{2.5}$) and coarse ($PM_{2.5-10}$) modes in the quarry and at the nearby receptor sites reported in Figure 1.

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