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Firewood for firesetting in the PbS Vallauria Mine in the Middle Age (Tende, Alpes-Maritime): contribution of dendrochronological and anthracotypological approaches

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CONTEXT AND OBJECTIVES

Numerous fragments of wood and charcoal have been sampled in the Medieval mine of Vallauria located in the Alpes-Maritimes (France) (Fig. 1). This great PbS mine was exploited at least from the 11th c. using firesetting to attack hard gneiss rocks (Ancel et al., 2022).

Firesetting consisted of building large pyres against working face and set it on fire. This technic required a lot of wood and produced numerous remains coming from log splitting and charred pyres. Several remains of fireplaces were found and sampled to develop dendrochronological and anthracotypological analyses. To achieve this, it was necessary to use chronological references (Shindo and Tissot 2019; Corona et al., 2011) and construct dendrotypological references.

The aims of this study were to precise with high resolution the chronology of mining and characterize fuelwood (species, diameter, tree parts) and forest from which it came.



Fig. 6 Medieval underground working place



Fig. 1 Mine and sample sites location ©IGN

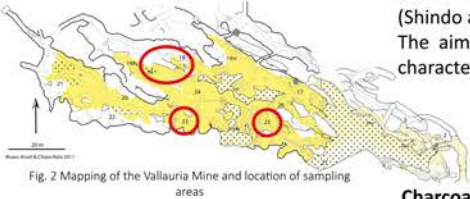


Fig. 2 Mapping of the Vallauria Mine and location of sampling areas



Fig. 3 Trunk cores and branch discs

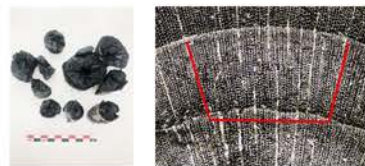


Fig. 4 Branch discs after charring

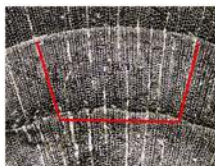


Fig. 5 Measurement of initial diameter of an archaeological charcoal

METHODS

Charcoal analyses: identification of 1592 charcoals coming from the Absides area (Fig. 2, 23); (i) measurement of radius curvature using AnthracoloJ (Fig. 5) (Paradis-Grenouillet et al., 2010) and reconstruction of wood diameter using ADModel (Dufraisse et al., 2018); (ii) measurement of tree-ring width using TSAP; (iii) crossdating of charcoal chronologies using CDENDRO (Fig. 8).

Wood analyses: identification of 61 fragments of wood coming from Absides (23), Pozzetto (25) and Pompe (18-19) areas (Fig. 2); measurement of tree-ring width using TSAP (Fig. 8); sample crossdating using CDENDRO (Fig. 8).

Anthracotypology (for the general method see the Alexa Dufraisse Keynote):

- i) Sampling strategies: 2 forest sites: Consiente and Minière (Fig. 1); 3 plots in each site, 5 fir and/or larch trees/plot; 2 cores and 3-4 branches sampled on each tree for a total of 46 fir cores and 72 branches and 30 larch cores and 43 branches (Fig. 3);
- ii) Measurement of tree-ring widths using TSAP (Fig. 8);
- iii) Charring of branch discs at 500 °C (Fig. 4) and new measurement of tree-ring widths;
- iv) Differentiation of average tree-ring rates between branches and trunks (Fig. 7).

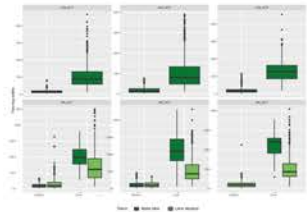


Fig. 7 Boxplots showing the distribution of trunk and branch ring widths measured for *Abies alba* and *Larix decidua*

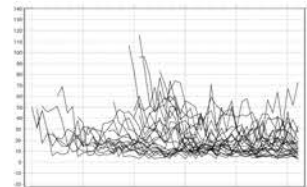


Fig. 8 Crossdating of charcoal chronologies

RESULTS

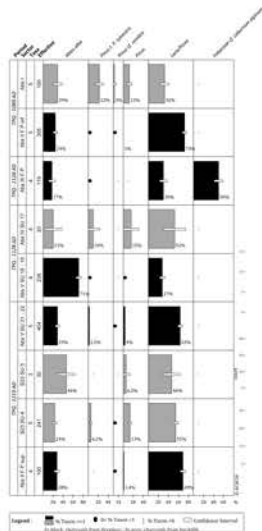


Fig. 10 Anthracological spectra of the different Absides SUs



Fig. 11 Diameter class distribution of charcoal

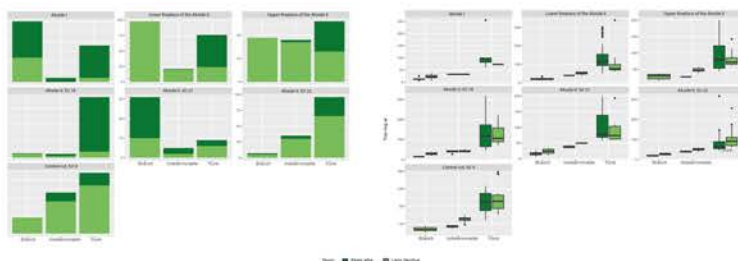


Fig. 12 (a) Box-plots of tree-ring widths of measured on fir and larch charcoals coming from Absides (b) proportion of branch, trunk and indeterminate charcoals in the different deposits of Absides

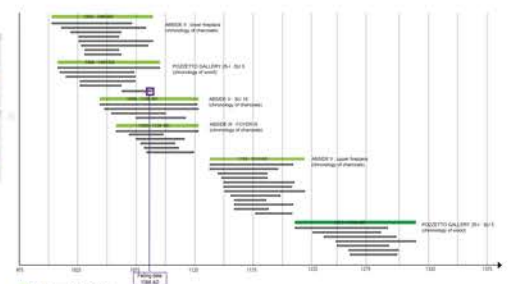


Fig. 13 Block diagram of charcoal and wood ring width chronologies

DISCUSSION - CONCLUSION

Mining began probably during the first half of the 11th c. and the western face of the mine (Absides) was reached around 1123. Mining was thereafter reactivated in the same area during the first half of the 13th c. (abside II, superior pyre). Another attempt to re-exploit have been detected nearby Pozzetto underground entry, around the start of the 14th c.

The main trees logged for mining in the Absides area were larch, fir and pines. The miners used also some Fabaceae. Results suggest a supply of wood from coniferous forests of the montane and subalpine levels, on both north and south-facing slopes. Larch forest was already well developed on both slopes, but, in which, fir (north slopes) and pines (south slopes) are still present. Miners used entire trees with large diameters. Proportions of wood coming from branches and trunks varied depending on pyres. As some of branches are old (up to 70 rings measured), we can assume, based on our reference data, that some of the trees logged reached diameters up to 60 cm and ages superior to 100 years.