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From the Provence to the Alps: the origins and evolution of pastoral mobility in the Western Alps, interdisciplinary perspective

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Résumé : Le projet PATHWAY vise à étudier, dans la diachronie, la diversité des systèmes pastoraux dans les Alpes occidentales et leurs marges (France, Italie et Suisse), du Néolithique à l'époque médiévale. À partir de séquences archéologiques et paléoenvironnementales (séquences de sédiments lacustres), notre approche a pour objectif i) de caractériser la composition et la structure des troupeaux domestiques au moyen d'analyses de restes d'animaux issus de sites archéologiques (CCJ UMR 7299, LAMPEA UMR 7269, LA3M UMR 7298-AMU, Aix-en-Provence), ii) d'appréhender différents paramètres-clés des systèmes pastoraux (alimentation, mobilité et saisonnalité des naissances) des principales espèces domestiques (mouton, chèvre, vache) et de proposer des axes de circulation à travers un large gradient altitudinal, grâce au déploiement d'analyses biochimiques (analyses isotopiques du strontium, de l'oxygène et du carbone) sur les molaires de ces herbivores (Universités de York et Southampton, Royaume-Uni ; CCJ UMR 7299), iii) d'appréhender l'économie pastorale au travers d'études des archives textuelles (TRACES UMR 5608, Toulouse), iv) de préciser grâce au carottage du remplissage sédimentaire de lacs alpins (EDYTEM UMR 5204, Chambéry) l'impact du pastoralisme sur les paysages de haute altitude en identifiant les phases d'érosion (sédimentologie), les changements de végétation (palynologie et ADN sédimentaire ancien : ADN_a) et l'identification des espèces animales pâturent les versants (ADN_a).

Mots clés : Pastoralisme, Alpes occidentales, troupeau, mobilité, paysage culturel.

Abstract: The PATHWAY project studies the diversity of pastoral systems in the Western Alps and its margins (France, Italy and Switzerland), from the Neolithic to medieval times. Adopting a diachronic and interdisciplinary approach combining archaeological and palaeoenvironmental sequences, the aim is i) to characterise the composition and structure of domestic herds by means of analyses of animal remains collected from archaeological sites (CCJ UMR 7299, LAMPEA UMR 7269, LA3M UMR 7298-AMU, Aix-en-Provence), ii) to understand the different key-parameters (fodder, mobility and birth season) of the main domesticated species (sheep, goat and cattle) and to propose animal mobility patterns thanks to biochemical analyses (isotopic analyses of strontium, oxygen and carbon) of these herbivores' molars (Universities of York and Southampton, UK; CCJ UMR 7299), iii) to apprehend the pastoral economy employing documents from historical archives (TRACES UMR 5608, Toulouse), iv) based on the coring of French alpine lakes (EDYTEM UMR 5204, Chambéry), to determine the impact of pastoralism on high altitude landscapes by identifying erosion phases (sedimentology), vegetation changes (study of pollen

and ancient DNA: aDNA) and the identification of the animals species that grazed the slopes in the past (aDNA).

Keywords: Pastoralism, Western Alps, Provence, herd, mobility, cultural landscape.

Text: When summertime comes, the migration of the domestic herds from the lowland to the high-altitude pastures seems immutable, everlasting. In the Western Alps, if the seasonal mobility of the domestic herds may have Neolithic origins (Beeching *et al.*, 2000), the emergence of long-distance transhumance between lower Provence and the Alpine areas has long been attributed to the Roman period without tangible evidence. The earlier significant archival sources appear only during the 12th and 13th centuries AD (Burri *et al.*, 2018). Since the 1980s, pollen, charcoal and sediment analyses have demonstrated that pastoral activities have shaped the landscape, from the Mediterranean to the alpine vegetation belts (Vernet and Thiébault, 1987; Walsh and Giguët-Covex, 2020; Battentier, 2022). However, what is the role of the pastoral systems in constructing and maintaining these cultural landscapes? What were the composition and structure of the domestic herds? What were their starting areas and their destination (short or long vertical mobility)?

From 2018 to 2022, the program PATHWAY “Protohistoric to Medieval pastoralism in the Western Alps: the origins and development of long-distance transhumance” has been undertaken to answer these questions. Founded by A*MIDEX (France) and AHRC (United Kingdom), it is directed by Fl. Mocci (CCJ), P. Magniez (LAMPEA) and K. Walsh (University of York). This project is based on 25 years of diachronic archaeological and palaeoenvironmental research in Provence, Southern Alps and Northern Alps. These regions, respectively under Mediterranean or mountain climatic influences, have complementary growing seasons (from autumn to spring in the Low Provence *versus* in summer in the high altitude area) and different geological backgrounds (mostly limestone in the low land and the external range and mostly crystalline in the inner Alps). PATHWAY’s key aim is to document the complexity of pastoral mobility, phenomena that are poorly understood, despite the desire of France to inscribe transhumance on the UNESCO intangible cultural heritage List.

Our approach relies on i) twenty-six archaeological sequences over a broad altitudinal gradient, from the coastal plain to 2200 m in the Western Alps (France, Switzerland, Italy), attributed from the Neolithic to the Middle Ages, ii) five palaeoenvironmental sequences (alpine lake sediment cores) and iii) textual archives (figure 1). Livestock bones and teeth from archaeological sites allow us to identify the animal species reared (cow, goat, pig, sheep) and the production strategies (meat, milk, fleece, or a combination of these) according to the producer’/consumers’ social status (archaeozoological analyses led by CCJ UMR 7299, LAMPEA UMR 7269, LA3M UMR 7298-AMU). Isotope analyses were performed on a corpus of more than one hundred sheep, goat and cattle teeth. They are based on the principle that isotope signals are recorded in dental enamel during teeth growth, via ingested water and food, and provide a sub-annual record of the animal's lifetime. Thus, measurements of oxygen, carbon and strontium isotope ratios from domestic herbivors’ molars allow us to identify animal mobility patterns since these values depend on environmental parameters (geological backgrounds, hydrologic cycle and plants photosynthesis process). These analyses have been carried out at the Universities of York and Southampton, UK and CCJ UMR 7299. These data specify the original background of an animal and its mobility pattern. A fruitful collaboration with the shepherd training centre of the Domaine du Merle (Salon de Provence, Bouches-du-Rhône, France) has been developed to reinforce this innovative method thanks to isotope ratio measurements on the transhumant herds from this institution (figure 2). Palaeoenvironmental reconstructions, derived from sediment cores collected in high altitude lakes

(EDYTEM UMR 5204, Le Bourget-du-Lac) inform us about the erosion rate from the slopes, which is partly linked to the repeated displacements of the herds and flocks (sedimentological analyses). The identifications of pollen grains preserved in the lake sediments allow us to identify changes in vegetation and the role of pastoral activities in these changes. Spores of coprophilous fungi, that grow on herbivorous faeces are used to attest the presence of herds and flocks in the past. The analyses of ancient DNA from lake sediment are also used to identify crops or pasture and the animal species which have grazed the slopes. In the alpine area, historical research (TRACES UMR 5608, Toulouse) enables the assessment of the organisation of transhumant journeys and the role of lords, communities and towns in the regional and national pastoral economy (places of departure and arrival, date of transition across the toll-town, number of animals).

This program has also been awarded a grant for projects on culture of science founded by Aix-Marseille University and ARKAIA. Thus, we have developed different pedagogical tools to explain the issues of pastoral mobility to families and school groups (posters, games and out-door conferences).

Therefore, this international project, including innovative and well-established methods, provides archaeological and environmental data, covering six millennia, that reveal the complexity and pluralism of pastoral systems that continue to structure today's socio-ecosystems, from Provence to the Alps.

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Legend

Figure 1: The PATHWAY approach intended for wider public.

Figure 2: Methodological principles of sequential strontium isotope analysis in tooth enamel and example of implementation on a tooth of the modern Merle sheep reference. The horizontal striations observed on the tooth are due to sampling for oxygen and carbon isotope analysis (Programme AgroPaléoRepro, Dir. Balasse M).