Use of stable (HOCN) and radiogenic (Sr) isotopes to determine the geographic provenance and traceability of artisanal cheeses of Quebec, Canada

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Introduction

Analysis of stable isotopes has often been used to determine the traceability of different food products [1] The light stable isotope ratios in dairy products such as cheese can provide information for tracing geographical origin.[4] The province of Quebec is Canada's largest cheese producer and artisanal cheeses are becoming a larger part of this market. In this context, we selected artisanal cheeses from six different regions of the province of Quebec to study the applicability of light stables isotopes and radiogenic isotope (Sr) ratios as descriminants to provide geographic traceability.

Sampling method and results

The cheese samples were analysed for light stable isotope ratios (HOCN) which are mainly influenced by altitude, distance from the sea, use of fertilizer, rainfall, food type, temperature, longitude and latitude [2,3,6]. The Sr isotope analyses are indicative of the geology of the type of substrate of the grazing areas [5]. Prelininary results yeild $^{87}Sr/^{86}Sr$ ratios that vary from 0.71084 to 0.71347. These values reflect soils composed largely of galcial tills derived from either the Canadian shield or Appalachain Orogen. Stable isotope δD values vary beteween -103.06‰ to -55.74‰, and $\delta^{18}O$ between -17.99‰ to -7.54‰. In addition, samples of the food, water, soil and raw milk will also be analysed to determine if enrichment or depletion of the different stable isotope ratios occurs during the manufacture of milk and during the conversion of milk to cheese.

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Indian Ocean monsoon dynamics recorded in a speleothem from Socotra, Yemen

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On the arid Indian Ocean Socotra Island (12°30'36" 53°55'12"), the Intertropical Convergence Zone (ITCZ) induces a bimodal distribution of the precipitations. Rain falls only as the northward migrating ITCZ passes in May-June and as it returns southward from September to December. The watershed effect of the 1540m-high SW/NE oriented Haggeher Mountains forces precipitations to concentrate on the windward side of the range [1]. Multi-proxy analyses ($\delta^{18}O$, $\delta^{13}C$ & greyscale) are carried out at high resolution (500μm = time-scale ~3 years) on two stalagmites collected in the eastern part of the island: STM1 from the Hoq Cave and STM5 from Casecas cave, 6 km away. Based on TIMS U/Th-dating they resp. cover the last 6000 years and the last 1000 years. Spectral analysis of the obtained records reveals an important ~205-years component in STM1. Comparing the ∂18O & ∂13C records with a reconstruction of solar activity [2] indicates that for most of the last 6000 years periods of lower precipitation and less vegetation are associated with periods of high solar activity. Periods of low solar activity induce more precipitations and higher vegetation abundance. In Oman, solar activity is positively related with the intensity of the rainy seasons because of changes in the latitudinal position of the ITCZ and the convective activity [3]. The Socotra results independently confirm this hypothesis and refine it by identifying the 205-years "De Vries / Suess" sunspot cycle as the dominant forcing cycle for the Indian Monsoon Dynamics on a centennial scale.

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