Past and current climate changes, impacts on underground microclimates. What threats on prehistoric painted caves ?

François Bourges*†[1], Dominique Genty*[2], Frédéric Perrier*[3], Bruno Lartiges*‡[4], and Frédéric Girault*§[3]

[1]Géologie Environnement conseil – pas de tutelle – France
[2]LSCE (Laboratoire des sciences du climat et de l'environnement) – Centre national de la recherche scientifique - CNRS (France) – France
[3]IPGP (Institut de physique du globe de Paris) – Centre National de la Recherche Scientifique - CNRS – France
[4]UPS (Université de Toulouse) – Université Paul Sabatier-Toulouse III - UPS – France

Abstract

Most people who visited famous painted caves such as Lascaux or Chauvet caves were astonished by the great freshness of the deep black drawings and colored paintings that have been dated up to 37 kyr old. This exceptional preservation is mainly related to strong regulation processes that maintain stable microclimates in karstic caves. Exceeding critical thresholds for underground key parameters (i.e. temperature, humidity, pCO2, water flows) may trigger harmful situations for the most fragile remains. Nevertheless, the oldest and most beautiful prehistoric sites (i.e. Chauvet, Lascaux) endured the most important climatic variations during the Last Deglaciation period from the Last Glacial Maximum _˜20kyr ago to the Holocene maximum _˜8kyr. For the oldest periods, during Marine Isotopic Stage 3, these wall paintings resisted large temperature changes during abrupt climatic events such as the Dansgaard-Oeschger ones. On the contrary, several prehistoric sites have been damaged very recently (i.e. Pech-Merle, Gargas, Marsoulas) where drawings have been tone down or even erased. This is mostly due to human activity in the cave or nearby, but one can ask what will be the consequences of recent climatic changes and of its impact on cave atmosphere characteristics. **Can we see any changes in the cave natural system and in its regulation? Does the current and predicted climate instability induce significant risk for preservation? Can we evaluate the consequences for the most vulnerable archaeological patrimony?** *Thanks to long term observations that was started more than 20 years ago, we are able to observe* temperature trends in many sites suggesting that climatic changes may have already started to impact cave climate. Among the most striking changes is certainly the increase in the CO2 concentration inside the caves (up to +23% for the maxima in 20 years) reaching the threshold above which we will not be able to enter the caves. In order to anticipate the consequences of natural and human impacts on the preservation of cave prehistoric art, it is now necessary to have a rigorous approach of climatic and geochemical parameters survey (i.e. cave monitoring) and of the physical understanding of the processes involves in the interactions between air/rock/water.

*Speaker
†Corresponding author: fbourges@geconseil.com
‡Corresponding author: bruno.lartiges@get.omp.eu
§Corresponding author: girault@ipgp.fr

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