

## **Crustal fluids in the Nepal Himalaya: spatial organization and sensitivity to the earthquake cycle**

Girault F.\*<sup>1</sup>, France-Lanord C.<sup>2</sup>, Adhikari L.B.<sup>3</sup>, Upreti B.N.<sup>4</sup>, Paudyal K.R.<sup>5</sup>, Gajurel A.P.<sup>5</sup>, Agrinier P.<sup>1</sup>,  
Losno R.<sup>1</sup>, Groppo C.<sup>6-7</sup>, Rolfo F.<sup>6-7</sup>, Thapa S.<sup>1</sup>, Tamang S.<sup>1-6</sup> & Perrier F.<sup>1</sup>

<sup>1</sup> Institut de Physique du Globe de Paris, CNRS-Université de Paris (France). <sup>2</sup> Centre de Recherches Pétrographiques et Géochimiques, Université de Nancy, Vandoeuvre-lès-Nancy (France). <sup>3</sup> Department of Mines and Geology, National Seismological Centre, Lainchaur, Kathmandu (Nepal). <sup>4</sup> Nepal Academy of Science and Technology, Kathmandu (Nepal). <sup>5</sup> Central Department of Geology, Tribhuvan University, Kathmandu (Nepal). <sup>6</sup> Dipartimento di Scienze della Terra, Università di Torino. <sup>7</sup> Istituto di Geoscienze e Georisorse, CNR, Torino.

*Corresponding author e-mail:* [girault@ipgp.fr](mailto:girault@ipgp.fr)

*Keywords:* hydrothermal system, carbon dioxide, Himalaya.

Over its 800 km strike, the Nepal Himalaya exhibits numerous geothermal zones located in the vicinity of the major thrust fault systems. Characterised by high thermal gradient, the hydrothermal sites show various surface manifestations: thermal springs, travertine deposits, hydrothermal alteration, ‘tectonic’ fumaroles and diffuse degassing structures. Gas released is dominated by carbon dioxide (CO<sub>2</sub>), with steam and trace gases (hydrogen sulphide, radon, helium). Isotopic signature suggests that CO<sub>2</sub> is produced at pluri-kilometric depth by metamorphic activity, percolates toward the surface along fault and fracture networks, and can mix with infiltrated meteoric waters and degas at shallow depths before reaching the surface. The hydrothermal activity depicts a large-scale spatial organisation related to the seismic segmentation of the chain. Catastrophic events such as large earthquakes influence the temporal variations of the hydrothermal activity. The hydrothermal systems appear as precious assets for the study of past, present and future Himalayan orogenic activity, and a unique probe of active metamorphic and alteration processes.