

Géosciences Paris-Sud



Earth sciences at **Geosciences Paris-Sud** are oriented toward the study of geological processes produced and/or recorded at the surface of the Earth and terrestrial planets. They are focused on the characterization, tracing, measurement and modeling of these interactions in surface and subsurface environments and their reconstruction back to the past.

GEOPS is a « Unité Mixte de Recherche » (UMR) of University (« Université Paris Sud Orsay ») and CNRS (« Centre National de la Recherche Scientifique »). At university, GEOPS belongs the « UFR des Sciences » and its department of Earth Sciences. The laboratory is located on the Orsay campus in two buildings (504, 509) of the « quartier du Belvédère ». It belongs the « Observatoire des Sciences de l'Univers de Paris Sud » (OSUPS). It is composed of 63 permanents (teachers-researchers, researchers, engineers, technicians and administrative people) and 50 PhD student, postdoc and ATER.

Research themes

Earth sciences at University Paris Sud are oriented toward the study of geological processes produced and/or recorded at the surface of the Earth and terrestrial planets. They are focused on the characterization, tracing, measurement and modeling of these interactions in surface and subsurface environments and their reconstruction back to the past. The study field of GEOPS is divided in 5 themes :

- Study of the continental part of the water cycle by integrating climate and anthropogenic constraints, particularly in the frame of the protection and sustainable management of water and soil resources
 - Impact of recent climate changes on the permafrost in Yakutia and on Mars, modeling of active erosion processes on Mars due to water ice and CO₂ exchanges, determination of the present impact flux and characterization of impact structures in the Solar System, modeling of primitive magma oceans on terrestrial planets, modeling of thermal exchanges in periglacial context
 - Study of the dynamics of Earth climates during terminal Quaternary and of its impact on terrestrial surfaces (erosion) and marine ecosystems
 - Tracing of the history of volcanic systems through the use of dating techniques such as K-Ar or Ar-Ar, and risk factors resulting from their evolution
 - Study of the thermal history of rocks (burying and/or erosion stages) in mountain ranges and in sedimentary basins, circulation of associated fluids and diagenetic modifications, genesis of metal concentrations and storage of nuclear waste
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and 2 transversal axes:

- Study of the impact of climate change in arctic regions
- Use of tephrochronology for studying past climates and volcanic hazard.

Main international projects

- FP 7/ IRSES " Nickel dynamics in impacted ultramafic soils"
- Implication in LMI (?Laboratoire Mixte International?) CLAREA "Climate Land Agro-ecosystems in East Africa ": analysis of the interactions between hydroclimatic variability, societies and agro-ecosystem resources
- PHC Tassili (Algeria), PHC Stefanik (Slovakia), collaboration CNRS/CNRT (Morocco), Darius program (Iran) on the themes topography-basin, diagenesis and deposit formation
- Interpretation of PFS Mars-Express data (IAPS, Roma)
- ANR CLIMAFLU with the Permafrost Institute of Yakutsk on permafrost melting
- French-Swedish project on the variability of southern climate
- LIA MONOCL (cooperation with LSCE and China) on the dynamics of Asian monsoon
- European network GTS-next on the calibration of time scales
- French-Italian University (UFI) on evolution of recent volcanic systems

Collaborations

We already work in collaboration with other laboratories of IPSL, mainly LSCE in the fields of climate, continental water and permafrost modeling, and also LATMOS and LMD in planetology. On Orsay campus, GEOPS collaborates with several physics laboratories on interdisciplinary research programs (FAST, IPN, CSNSM, IAS) and a biology laboratory (IBP).

Main international collaborations:

- UMS LSBB (?Laboratoire Souterrain Bas-Bruit de Rustrel?), in the frame of the ?Idex MIGA?, on the monitoring and multigeophysical characterization of an analog of a geological reservoir
 - Universities of West and North Africa (Abidjan, Agadir, Alger, Marrakech, Niamey, Nouakchott, ?) in the field of groundwater resource assessment
 - Diverse universities (UK, USA, Belgium, Morocco, Japan, Algeria) on the themes topography-basin, diagenesis and deposit formation
 - Open University (UK) for the analog simulation of debris flows
 - Smithsonian National Air and Space Museum (US) on the study of impact craters
 - University of Heidelberg on Atlantic hydrology
 - Diverse universities (Damascus, Lisbon) on the study of volcanism
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Experimental developments

The study of the interactions between the different reservoirs of the terrestrial surface is tackled through a quantification using geochemical, mineralogical and geophysical tools, and analog and numerical modeling, and also makes use of terrestrial and planetary surfaces imaging. Several innovative experimental developments may be listed:

- Tracers for groundwater dating (H₂O-Max platform shared with LSCE)
- Thermochronological methods of fission traces and (U-Th)/He on various mineral phases for the quantification of erosion/burying phases or the dating of alteration or mineralization phases
- Mass spectrometry for the measurement of argon isotopes
- Hydraulic channel in a cold chamber for analog modeling
- Relative and absolute dating by using the geochemistry of radio-chronometers : ¹⁴C by AMS (link with ARTEMIS Saclay), K/Ar and ⁴⁰Ar/³⁹Ar, and dating of the surface of Mars by counting of impact craters
- Utilization of geo-tracers for tracing processes at the interface between different compartments of the terrestrial surface and reconstruction of past evolution of climates and terrestrial environments (⁸⁷Sr/⁸⁶Sr, ¹⁴⁷Nd, ?)

The instruments are distributed over three experimental platforms composed of about 30 instruments : (i) Geochemistry, (ii) Mineralogy, (iii) Geophysical measurements and analog modeling. A part of the geochemistry and mineralogy platforms is in the course of being shared with LSCE within a common analytic platform of geochemistry and geochronology of the Paris Saclay Campus. A part of the geophysical platform is shared with UMR FAST within a common platform devoted to the study of geophysical processes named PEPS.

Valorisation / Expertise

Societal by-products of Earth science research led in Orsay are multiple: management of water and soil resources, exploration and exploitation of mineral resources, geological materials and fossil energy sources (uranium, oil, gas), geological hazards, storage of nuclear or domestic waste and consequences of climate change on the evolution of our environment. Members of GEOPS provide their expertise for several public or private companies (ANDRA, AREVA, Gaz de France, IFP, Total, CEA, IRSN, IFREMER, ?). The laboratory has developed a partnership with the section « Isotopic Hydrology » of IAEA (International Atomic Energy Agency), with 4 researchers playing the role of experts.

Direction team

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Access to the GEOPS website
