Centre de la Recherche Scientifique de Dersim et Koçgiri

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ON THE ENVIRONMENTAL MINERALOGY AND ON THE ECOLOGICAL GENOCIDE

This research is dedicated to Professor Sir Ezize CEWO

the Sacred Valley of Munzur in Dersim

When the Academy of Sciences organized the symposium on the ENVIRONMENTAL MINERALOGY the Sacred Valley of Munzur will disappear. It is an ecological and cultural genocide before the world public opinion. It is a violation of international law. This practice of the imperial Turkish government is opposed to the Final Declaration of the United Nations Conference on Environment and the Kyoto Protocol to the Convention for the protection of national and international protection of cultural and natural heritage. Because we believe that degradation or loss of property of cultural and natural heritage constitutes a harmful impoverishment of the heritage of all peoples of the world, and the protection of this heritage at the national level often remains incomplete because of the scale means it requires and of the insufficient economic, scientific and technical services of the country on whose territory the property to safeguard. Because the Constitution provides that the

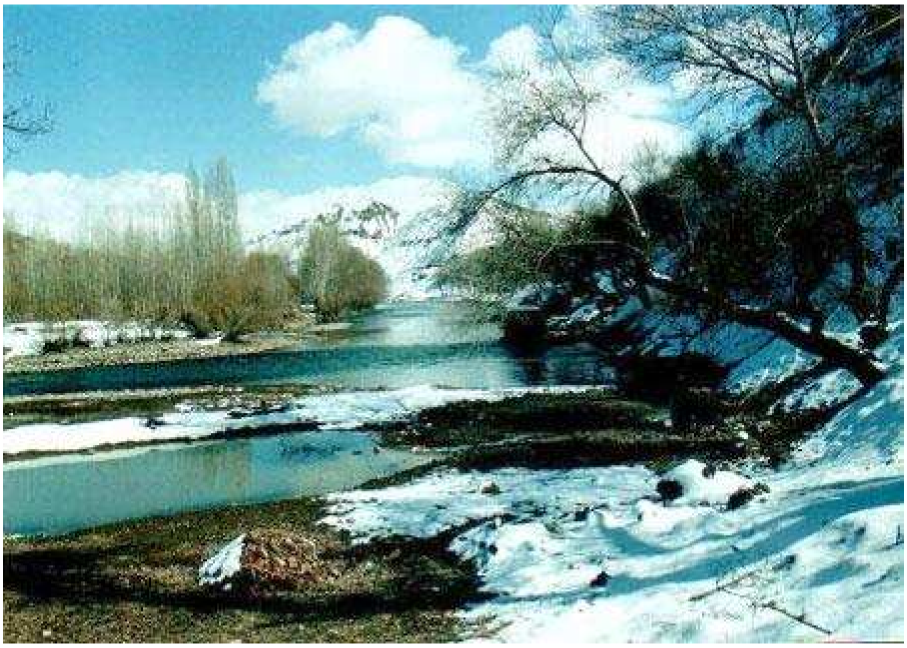
Organization will maintain, increase and diffuse knowledge by assuring the conservation and protection of heritage, and recommending to the nations concerned the necessary international conventions because and conventions, recommendations and resolutions in support of existing cultural and natural property demonstrate the importance, for all peoples of the world, of safeguarding this unique and irreplaceable property, to whatever people they belong. So the Turkish colonialists have no right to remove a natural civilization of 42 million years. It is an ecological crime of genocide which my country has undergone. Under the Convention on the Conservation of European Wildlife and Natural Habitats of Europe, it is unacceptable that the Turkish colonial state violates the convention that "This Convention aims to ensure the conservation of flora and fauna and their habitats, including species and habitats whose conservation requires the cooperation of several States, and to promote such cooperation. Particular attention is given to species, including migratory species, endangered and vulnerable "while with the construction of eight dams on the sacred river of my country in 1817 species will disappear. That this practice is not consistent with the "Convention on the Conservation of European Wildlife and Natural Habitats of Europe, adopted at Berne, September 19, 1979.

The fauna and flora are a natural heritage of major interest to be preserved and transmitted to future generations. Beyond the national emergency, the parties to the agreement believe that cooperation at European level must be implemented.

The Convention aims to promote cooperation between the signatory states to ensure the conservation of flora and fauna and their natural habitats and protect endangered migratory species extinction. " Moreover, the Bern Convention of 1982 "aims to ensure the conservation of flora and fauna and their natural habitat. It pays special attention to species (even migratory) endangered and vulnerable in the annexes. The Parties undertake to take all appropriate measures for the conservation of flora and fauna especially in the development of national policy planning and development, and in the fight against pollution, this objective be taken into consideration. The Parties shall also encourage education and dissemination of general information regarding the need to conserve wild natural heritage.
"

This practice of colonialist Turkish state is opposed to the Convention on Biological Diversity that "biological diversity and value diversity and its components on the environmental, genetic, social, economic, scientific, educational Cultural, recreational and aesthetic, and also that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be invoked as a reason for postponing measures to enable avoid the hazard or mitigate its effects, and further that the conservation of biodiversity requires essentially in situ conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural environment . Under the Convention "a large number of local communities and indigenous people close and traditional dependence on biological resources embodying tradition and the desirability of sharing equitably benefits arising from the use of knowledge, innovations and practices relevant to the conservation of biodiversity and sustainable use of its components "The colonial policy of Turkey in the historical heritage of Dersim is a negation of international law and the Universal Declaration of Human Rights. As to the Convention for the Safeguarding of the architectural heritage because of the archaeological heritage is essential for knowledge of past civilizations, the responsibility for protecting the archaeological heritage should rest not only the State directly concerned but also the all the European countries to reduce the risk of degradation and promote conservation by encouraging exchanges of experts and experience, so the purpose of this Convention (Revised) is to protect the archaeological heritage as a source of European collective memory and as an instrument of historical and scientific study. As are included in the archaeological structures, buildings, groups of buildings, developed sites, moveable objects, monuments of other kinds as well as their context, whether situated on land or under water. Finally unfairly Department Dersim disappear with the sacred river Munzur and heritage. International instruments relating to the preservation of cultural heritage stipulate a system of cultural references is essential to the development of a nation and the people as a whole, benefits from the preservation of cultural heritage of every society. These

instruments relating to the preservation of cultural heritage ranging from protection of architectural heritage to the underwater life through heritage protection in wartime. The folklore is part of the universal heritage of humanity, it is a powerful means of bringing together different peoples and social groups and of asserting their identity culturelleLe colonialist government of Turkey has not fulfilled the proposed resolution European Parliament has called "the Turkish government to apply European standards in the case of projects with significant impacts, such as construction of dams in the valley Munzur, Allianoi dam, construction of the Ilisu Dam and the gold mining in Bergama and other regions which threaten both the historical and unique sites and precious invites the Turkish government to make reference to Community legislation in the context of developing regional development projects "



Dersim has stood for centuries to foreign invasions and has always managed to keep a sort of "independence". This situation has persisted sixteen times under the Ottoman occupation and armed resistance lasted from 1908 to 1938 during the first two decades of the new Turkish Republic was proclaimed in 1923 has committed genocide physical. After founding of Turkey, Atatürk had one last thing to do "civilize Dersim". We understand better the nature of this "mission of civilization" through his speech before the Turkish Grand National Assembly: "Dersim is a tumor to the Government of the Republic. Whatever the price, this tumor must be removed through a final transaction said the "Eternal Leader" of Turkey. Everything happens very quickly: In 1935 a new law, it prohibits not only the use of the name of Dersim Genocide, but also with the people of Dersim been. and they renamed the region. The new name is not without irony: Tunceli is to say the "hand bronze" in Turkish. After prepared, the Turkish army began moving in 1937 to "the land of the oak," Dersim. The resistance leaders were arrested and then executed November 15 in 1937 thirty minuite when the arrival of Mustafa Kemal in El Azis' age of 81, despite the law prohibiting the execution of a person having such an age. The operation lasted a total of two years and provides a tragic outcome for the region: 170 000 deaths and thousands of people deported to the west of Anatolia to facilitate their assimilation. It was the only time the Dersim mountains are considered sacred by the locals have forsaken their people to their fate. Thus they tasted defeat. At the heart of the region is the chain of mountains Munzur whose highest peak reaches an altitude of 3462 meters. The river which crosses the region bears the same name. Dersim presents a unique bio-diversity. Considering the wealth of the region, December 21, 1971 the Turkish state says the River Valley Munzur 'first national park of Turkey and he is currently the largest in the country. The valley has a length of 80 kilometers. With Munzur Mountains is home to 1518 plant species of which 227 exist in Turkey and 43 only in the valley Munzur. The natural wealth of the region is comparable to that of an entire country .. In the Valley and on the chain of mountains Munzur we also find a rich fauna. There are animals endangered as the brown bear, wild cat, wild sheep, mountain goat horns fangs, in the river there are trout whose particularity is to have red scales.

Dersim region is certainly a very rich, but wealth did not put away a potential disaster. The region is this time threatened with ecological disaster. For the Turkish state plans to build in the Valley Munzur eight dams and hydroelectric plants. What can the construction of these dams in the region? They provide 0.97% of total electricity production of Turkey. What are the consequences? First, 84 villages will be submerged under water and dams will cause irreparable damage to the region that has already lost much of its population because of the depopulation policy practiced by the Turkish state during its war against the Kurdish guerrillas which intensified in the 1990s. Secondly, the region will be divided into two and thus lose its geographical unity; the risk of creating many economic and cultural. Thirdly, the drastic climate changes occur and the endemic plants, rare animals lose their habitat, then disappear. Finally, the Valley Munzur which was formed 42 million years, according to experts, will be completely destroyed. According to expert opinion a dam has an average life of 70 years and after this period we will be left in ruins in place of the heavenly beauty of the valley.

The symposium of the Academy of Sciences on the ENVIRONMENTAL MINERALOGY was organized by the Scientific Committee composed by scholars and academicians following 14 and September 15 in Paris[1] the Scientific Committee composed by

[1] **ACADÉMIE DES SCIENCES, INSTITUT DE FRANCE**
14-15 septembre 2009 Grande salle des séances, Institut de France, 23 quai Conti, 75006 Paris.

Gordon E. Brown, Jr., *Stanford University*
Georges Calas, *Université Pierre et Marie Curie, Paris*
Jean Dercourt, *Secrétaire perpétuel de l'Académie des sciences, Paris*
Adrien Herbillon, *Université catholique de Louvain-la-Neuve*
Zdenek Johan, *de l'Académie des sciences, Orléans*
Ghislain de Marsily, *de l'Académie des sciences, Paris*
Georges Pédro, *de l'Académie des sciences, de l'Académie d'agriculture de France,*

On the scientific question of the "geosphere" has many definitions. Some authors extend from the upper atmosphere to the center of the lithosphere! The physical world, the universe, all things and beings, the reality: The wonders of nature. Set of forces or higher principle, regarded as the origin of things in the world, its organization: Nothing is lost, nothing is created, it is a law of nature. All principles, forces, particularly of life, as opposed to the action of the man she had lost confidence in the nature and doctors.

Philosophy state of nature situation that would have found the human society, such as before when the men, while living together, would have created no common institution and, thus, would have been no political authority . (The state of nature is a commonplace of political philosophy of the seventeenth and eighteenth century idea of nature, idea behind the organization of the cosmos, as for Aristotle, or that a particular being.

The apprehension of nature as a creative power uncreated, impersonal sovereign and is probably the first to be imposed on men, when they had to continuously measure the "natural elements". In any case, since the sixth century BC flourished in Greece, treaties Peri phuseos ("From Nature"): Anaximander, Anaxagoras, Parmenides of Elea, Heraclitus, and Empedocles and Epicurus have to turn physis ride called the infinite and unchanging principle of all things finite and perishable.

It is Aristotle who developed the further systematization of the idea of nature in a cosmology that was to rule unchallenged until the advent of Galileo's physics, and especially that of Newton. The Greek word physis, which we translate as "nature" (Latin nasci, natus "born," born ") and has given French" physical "has the same root as" fetus "and comes from the verb phuein , which means "grow", "push", "grow" by saying physis, Aristotle said, it feels like a push perennial growth. Nature is indeed the cause immanent "has in itself the principle of its movement. And, says Aristotle, "the god and nature do nothing in vain."

Nature is composed of four simple elements: water, air, earth, fire. In the center is the earth (severe absolute dry) at the periphery, fire (dry and light absolute) and in the meantime, air (light on and wet) and water (wet and severe relative) . The man is a mixture composed of four elements, called to join their "natural places in the cosmos: geosphere (land), hydrosphere (water), atmosphere (air), pyrosphere (fire). Einstein did not hide his admiration for this ancient cosmology qualitative, which traces remain vivid in our language and our attitudes, as shown by Gaston Bachelard.

Heir of Democritus and Epicurus, Lucretius gives the Latin to turn in his poem **De rerum natura** image of a goddess "free, unencumbered by great masters, self-governing his empire without coercion and without the aid of gods. This idea of nature, perpetual scene of generations and corruptions, where nothing comes from nothing but everything is transformed, influenced all the "systems of nature" pantheistic materialists and atheists.

In my thesis in Greco Roman philology, in 1973 I analyzed the materialist conception of the soul from Lucretius, I have studied the report of the physical and Aristote Epicurean physics that underlies the design of the world of Lucretius. The declination of the atom and the qualities of the atom was indivisible principles and elements indivisible dialectically.[2]

I think the ideas of Lucretius on the mount Etna volcano are very accurate and contemporary. It is a scientific and philosophical observation. See the comments of the Latin poet and philosopher Lucretius

“Who among us is surprised that a patient feels in his body burning with fever or its members in the pain of any other ailment? Suppose that the foot swells suddenly a sharp pain or seize the teeth, attacks the eyes, or the sacred fire broke do, wandering throughout the body, burns all parties that reached and seizes the body it is clear that the cause is in the multitude of existing principles, the earth and the sky of our world are in themselves enough morbid elements to enable him to train sickness of appalling proportions. So surely as heaven and earth can receive 665 infinite elements capable enough to suddenly shake the earth, land and sea travel in fast eddies, to fill 1'Etna lights, d ' light the fire in the sky. Yes, the sky itself can catch fire, take the celestial fire, like rain falling storm with more violence when are assembled in more somewhere elements of water.

But it is huge, the fire blazing Etna! Without doubt, but is there a river that appears great who has never seen more? And of the same tree, so a man in all things, what we've seen bigger, they imagine vast. Yet all this, with heaven and earth and sea, is nothing compared to the total mass of the great whole. Now however, I will explain how the flame suddenly angry burst of 680 large furnaces of Etna. First the whole mountain is hollow and almost all made

[2] Dr Ali KILIC, La conception matérialiste de l’ame chez Lucretius, Istanbul , fevrier 1973,p.12

of granite caves. In all there are air, wind. The wind from the air stirred and shaken. When it has warmed and that it has infuriated all blazing around him, rocks and earth, and he has brought forth rapid jets of fire, then stands and takes his momentum straight through gorges of the volcano. It can then l) orter off the flame, garlic disperse far cendrc, roll the black smoke swirling in while throwing stones enormously heavy, can you doubt that all this has its cause in the power of a raging wind? On the other hand, the sea bathing the foot of the mountain on a wide range, including wind and the waves turn the reform. Now from the edge of the sea caves of the mountain gorge extending up inside the volcano. Through it pass the winds when the sea receded, it is necessary, and it obviously, and that is where they direct their blows towards the top, then they escape blowing flames, throwing stones and raising clouds of sand. At the top of the mountain, in fact, are the craters is the name given them by the locals, the rest of us call them Gorges and mouth. There are still many phenomena for which he would not propose a single cause, but the various causes proposed one is true, so if, for example, you see at some distance a man lying unconscious on the ground, c ' is by listing all probable causes of death that you tell the true. In fact, you can not decide if he has perished by the sword, by cold, by illness or perhaps by poison, but only one of these causes is due to his accident, is our certainty.

This is in many subjects the right way. The Nile swells in the summer and then overflows into the valley itself, which bathes the whole of Egypt, he alone of all rivers in this plan. It I'Egypte watered regularly during the full heat, probably because in this season Etesian prevailing winds, north winds are the fly at the mouth of the river and their breath, taking him down, delaying its waters, them back in his bed height and forces them to stop. For it is certain that these winds blow in the opposite direction of the river, as they arrive constellations icy pole. And contrary to him, he comes from the torrid zone where soils 1'Auster; among the races of men in black complexion sunburned,

Giordano Bruno (1548-1600) was born in Nola near Naples where his father was a humble soldier. After studying theology and philosophy, he entered the Dominican order. He quickly noted by his rebellious spirit, and, knowing himself suspected of heresy, he must leave Italy. It is found in so many universities and royal courts across Europe (For example, he teaches at the College de France). His most striking feature is the banquet of ashes where there is a vindication of Copernicus ("It shows how Copernicus is worthy of our praise") and a critique of Aristotle. It goes beyond Copernicus and declares that: the mass of the universe is infinite and that it is futile to seek the center or the circumference of the universal world. He then states that: heaven of the fixed [the sky and its stars] 's not a sky where the bodies we see shining would all laugh the same distance from the center, some seem close at hand, which are more distant from each other they can not be one and the other of the Sun and

Earth. It endangers arguing that there are other suns and other land where life exists. He aggravated his case by denying transubstantiation [3]. the virginity of Mary and the Trinity, and by resorting to magical practices. After a trial lasting seven years, he was burned alive February 17, 1600

Unlike Galileo, G. Bruno has not recanted, and he told his judges, December 21, 1599 "I do not repent, and there is not repentance. There is no material on which to repent, and do not know on what I have to repent by the principle of inertia

Giordano Bruno almost borders on inertia. He understands that the motion of the earth over didn't observable effect on the movements of its inhabitants that the uniform motion of a ship does on those objects located inside a cabin. It is therefore aware that the movement is that from a mechanical system and a place (that is to say a point) can belong to two or more systems without prejudice to the movement of objects in it found (De infinito, one iverso e Mondi, 1584). But unlike Galileo, he did not press the descriptive power of mathematics, much less operating power, which will tell Kepler 'unfortunate Giordano Bruno

Galileo's contribution is immense. He is the founder of mechanics, general science movement. As Whitehead says: nor would he not been without Newton Galileo, and it is just ironic that he would not have by Galilee without Newton. He adds: Galileo represents an assault Newton victory. Galileo can be considered the father of modern science because it does as a criterion of truth that experience and careful reflection. It combines the use of mathematics in a way which guarantees the objectivity. He puts the point very clearly in it Saggiatore:

The philosophy [that is to say science] is written in this great book which stands continuously open before our eyes, the universe, and which can be understood if one has previously learned to understand language and know the characters used to write it. This book is written in mathematical language its characters are triangles, circles and other geometric figures without which means it is impossible to understand a single word humanely and without which we do wander in vain a dark labyrinth.

In 1616, the humanist Giulio Cesare Vanini published his speech on the secrets of nature, queen and goddess of mortal brought before an ecclesiastical court, he maintained that "God manifests itself at every moment, more than a few miracles often challenged by this great miracle undeniable, relentless and always new that we call nature. This statement, considered

[3]) This mystery is the transformation, at the consecration of the host, the bread and wine into body and blood of Christ.

impious, condemning him to the stake, and he was burned at Toulouse February 9, 1619 at the age of thirty-four.

Observe, measure and model our land to better understand, manage and teach, summarizes the vision of Sciences Terre. His scientific approach designs the geosciences as a whole, since the earth's surface to depths of Earth internal, and this at all scales in time or space. The multidisciplinary aspect of research is highly developed to address the major issues raised by the study of the dynamics of Earth's internal structure and evolution of planets, the dynamics of the natural environment and the impact of human activities, modeling, prediction and management of natural disasters, earthquakes and volcanic eruptions.

Basically, Earth is a natural multiscale complex which we seek to understand the dynamics. Scientists are particularly interested in following items: Dynamic cooling of the Earth, convection in the mantle, the core dynamics of volcanic eruptions, magmatic systems .. scientific structures were built with the aim of understanding the inner workings of the Earth's core to its surface, using the methods of physics and chemistry, the tools of mathematics and computer science. The Earth is a complex, heterogeneous and range of time scales (from seconds to billions of years) and space (nanometers to tens of thousands of kilometers) is a research area very special. Without doubt the field and observation of particular importance and collaborations with specialists from the atmosphere, ocean and climate, and more recently the life sciences, is growing. The activity of scientific research that is centered around the study of chemical and biological processes in aquatic ecosystems or not subject to heavy pollution such as lakes, rivers, wetlands and ecosystems marins. His activity revolves around 4 main themes:

The first deals with the dynamics of nutrients (C, N, S, P, Si, I, Mn, Fe, Mo) or related to the biological productivity of the ocean (Ba) in the water column and aquatic sediments. Particular attention is paid to diagenesis (physico-chemical and biological constituents of organic and mineral sediments).

The second study addresses the transfer of material in the soil solution continuum, river and wetland and fate of micropollutants such as heavy metals (Cd, Pb, Zn, and Cr). The roles and functions of organic matter, mineral phases and micro-organisms are studied in these two subjects because they play a major role in the fate of these elements during diagenesis and during their transfer to the biosphere.

Our third area of research is dedicated to identifying the role of bacteria (eubacteria and arche) in biogeochemical processes. It involves identifying metabolic pathways, to understand the dynamics of substrates at stake The fourth section covers the development of sensors for data acquisition physico-chemical in situ at high spatial and temporal resolution, in waters, soils and sediment. Understanding the processes involved in the global carbon cycle and associated trace elements is the common denominator of these four themes.

Therefore, the objective is a better scientific understanding of surface processes and sub surface involved in environmental issues. It is in this sense that the statement of the Academy of Sciences of the international symposium posed the following questions:

How minerals are they actors of sustainable development? How are they? How do they degrade? What do they maintain trade with the living?

At this international conference, * the best experts, French and foreign, will analyze the mineralogy, a field that focuses on the solid earth (geosphere) in terms of its relations with the hydrosphere (rivers and oceans) and biosphere (life). At each of four sessions, two lights, one on basic knowledge and experimental, the other on environmental and societal implications, renew our vision of an inert minerals, showing their close intertwining with the environment and our technological choices. This modern concept of a mineral dynamic, complex and reactive, based on the most recent instruments of physics and chemistry, which dissect the minerals like a "Meccano" in the community living in contact which they are formed or degraded. One understands better and better the role of soils as natural filters of our environment, and as an irreplaceable reservoir of nutrients for plants. More generally, mineralogical processes that play at the microscopic level are generators of global issues, recent developments in the Amazon to the impact of contaminants.

The introductory lecture will explain this recent concept of "environmental sciences at the molecular level, based on numerous examples in France and the United States (Gordon Brown and Georges Calas Co-organizers of the conference).

Session I "mineral-solution interfaces: responsiveness to pollution process" (Monday 10am-12.30pm), chaired by Georges Pedro Academy of Sciences, will focus on interfaces, which determine the formation of minerals. The process of pollution or pollution of soils are governed by the release or otherwise trapping heavy metals or arsenic (Laurent Charlet, Guillaume Morin and Jerome Rose). A thorough knowledge of the respective surfaces of minerals and bacteria facilitates the direct approach interfaces (Fabien Thomas). We understand now how minerals become less harmful in the deeper soil layers (Ruben

Kretzschmar).

Session II "Interaction between minerals and biological activity" chaired by Gordon Brown of Stanford University (California) looks at relations micro-minerals. We begin to realize the importance of the formation of bacterial biofilms, ubiquitous in the precipitation of specific minerals (David Vaughan). The nano-materials (oxides of titanium, for example) for industrial products represent a new source of disruption in our environmental monitoring (Jean-Yves Bottero). When minerals are synthesized by microorganisms, their biological origin is seen in texture and can thus date the first traces of life on earth (Karim Benzerara).

The Roundtable, chaired by Jean-Pierre Jolivet (Université Pierre et Marie Curie, Paris), will assess the relationships between chemical processes and process mineralogy.

Session III "Minerals, witnessed the formation and evolution of the soil", chaired by Adrian Herbillon (University of Louvain-la-Neuve, Belgium), show the link between the wealth of a ground and the nature of its minerals. The formation and degradation of spectacular Amazonian soils represent a textbook case of relations between the rivers and soil in a symbolic environment (Emmanuel Fritsch). The crucial role of clay minerals in soils will be specified (Sabine Petit). The state of iron also affects the fertility of soils, as illustrated by the extreme conditions, in reducing or oxidizing podzols laterites in the Sahel (Joseph Stucki).

Session IV "Mineralogy and strategy for waste storage" , chaired by George Calas (University Pierre and Marie Curie), will address the resistance to weathering matrix storage of nuclear waste. From their 2000 years, what information we provide archaeological glasses (Libourel Guy)? The uranium deposits are they good models for improving the safety of storage sites for nuclear waste (Rodney Ewing)? What are the alternatives to glass (Jean-Marc Montel)? Finally, we see the processes involved in geological storage of atmospheric CO2 (François Guyot).

The final round table , chaired by Jean Dercourt, Permanent Secretary of the Academy of Sciences, will focus on knowledge transfer from laboratory to field. How to move from atomic scale to the landscape? How to project into the future, with time scales of geological processes? How to use what is known about the minerals to meet the challenges of our society: waste storage, degradation or pollution of soil and water, and impacts of mining and industrial development sustainable?

The opening of the symposium will be made by **Jean Dercourt,** Permanent Secretary of the Academy of Sciences, and then the issue of environmental mineralogy: understanding the behavior of elements chemicals in ecosystems: Environmental Mineralogy , otherwise, Understanding Element Behavior in Ecosystems will be the subject of analysis **of Gordon E Brown[4] , Jr** and **Georges Calas** [5] the two scientists Gordon E. Brown, Jr[6]., and Georges Calas[7] think There is growing recognition that minerals and the natural environment are inextricably linked in a number of important ways. *Environmental Mineralogy* is rapidly expanding, integrating mineralogy with life sciences and geochemistry in order to understand interactions of the geosphere, hydrosphere, atmosphere, and biosphere. Minerals comprise many of the key components of our world, including soils and modern sediments, mineralized parts of living organisms, atmospheric aerosols, building materials such as cements, and many natural resources used by modern civilization. *Environmental Mineralogy* is also concerned with major issues such as the remediation of contaminated sites left by centuries of mining and industrial activities and the rapid development of commerce, the interaction of minerals with metal/metalloid contaminants, water, and biological organisms in ecosystems, and the disposition of contained nuclear and industrial waste. In addition, the development of novel technologies, such as the use of engineered nanomaterials as antibacterial agents, poses potential threats to human health. To address such issues at a fundamental level requires molecular-scale knowledge about biogeochemical processes at mineral surfaces, the defective nature of minerals, the structural chemistry of disordered materials (nanophases, glasses, gels, metamict minerals) and aqueous solutions, and the speciation of trace elements in minerals and solutions. Although they are not usually considered part of "classical" mineralogy, research in these non-classical areas is necessary to provide a coherent view of the interplay between pollutant release/sequestration/transport and the functioning of geochemical and biogeochemical systems.

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Environmental mineralogists have used a number of modern instrumental, laboratory, and theoretical methods to define how contaminant and pollutant atoms and molecules are associated with minerals at the atomic level and how various geochemical and biological processes affect their release into ecosystems. For example, the intense light from synchrotron radiation sources is now commonly used to determine how inorganic pollutants, such as arsenite, are bonded to mineral surfaces under various environmental conditions, to characterize the structure of hydrated mineral surfaces to which pollutants are attached, and to determine the alteration processes of minerals and glasses. Such molecular-level studies are often coupled with macroscopic studies of biogeochemical processes such as the interaction of microbial organisms with heavy metal contaminants, forming biominerals or transforming contaminants into more or less toxic forms, the corrosion of waste matrices, the behavior of nanominerals and mineral nanoparticles in different environments, and the formation of soils. Because of their high surface areas and enhanced chemical reactivities relative to their macroscopic counterparts, natural nanoparticles can play an especially important role in controlling the chemical behavior and transport of inorganic pollutants in natural waters and the atmosphere.
Our talks will focus on (1) the environmental mineralogy and microbiology of mercury in mining environments, (2) the nature and role of ferrihydrite nanoparticles in acid mine drainage systems, (3) the interaction of Pb(II) with Fe-oxide and Al-oxide surfaces, (4) the environmental mineralogy and geochemistry of arsenic in southeast Asia, (4) the role of Zr in the durability of nuclear glasses, (5) the use of radiation-induced defects of kaolinite in natural analogues and tropical soils, and (6) element speciation in soils developed on geochemical anomalies.[8]

The question of Reactivity at mineral-water interfaces, redox processes and arsenic transport in the environment was raised by Laurent Charlet[9] Guillaume Morin [10] Jérôme Rose[11] as follows;

Massive deleterious impacts to human health are resulting from the use of arsenic bearing groundwaters in South-East Asia deltas and elsewhere in the

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world for drinking, cooking and/or irrigation (Charlet and Polya, 2006; Polya and Charlet, 2009). Unless a scientific understanding of the redox mobilization/immobilization mechanisms at work is achieved and comprehensive effective water treatment measures are put in place, it is estimated that in Bangladesh alone, millions of people will develop arsenicosis and excess deaths of several thousand per year will result (Yu et al., 2003).

The fate of arsenic and other oxyanion forming metalloids (Se, Mo, P..) is controlled in natural systems as well as in engineered systems, such as modern water treatment plants, by Fe nanoparticles (Morin and Calas 2006). Depending on redox potential, total sulfide and carbonate content, different particles may constitute the controlling reactive surface. In our three groups we have investigated by XAFS spectroscopy, neutron diffraction, HRTEM and DFT molecular modeling, the sorption of arsenic onto ferric oxyhydroxides (Ona-Nguema te al. 2005), nano-maghemite (Auffan et al., 2008; Morin et al. 2008), nanomagnetite (Yean et al., 2005; Wang et al., 2008; Morin et al. 2009), iron hydroxycarbonates (Ona-Nguema et al., 2009), mackinawite (Wolthers et al., 2005), calcite (Roman-Ross et al., 2005) and gypsum (Fernandez- Martinez et al., 2008). Arsenite forms a specific triple corner sharing surface complex both with magnetite (Wang et al., 2008; Morin et al. 2009) and maghemite (Auffan et al. 2008), which explains in part the very high adsorption affinity of arsenite for these substrates. In addition, a “nano” effect is best observed for magnetite which may sorb 0.021, 0,388 and 1.532 mmol g-1 of arsenite, i.e. 5-6 Wmol m-2 to 18 Wmol m-2, when normalized to specific surface area, for particle size decreasing from 200 nm to 20 and 12 nm (Yean et al, 2005 ; Auffan et al, 2007; 2009; Morin et al. 2009). The origin of this increased reactivity is still a matter of debate, and could be due to increased surface tension (Auffan et al. 2008, 2009) or to surface precipitation of arsenite (Morin et al. 2009).. Polymeric arsenite surface complexes may also form at the surface of greenrusts and may play an important role in delaying the release of arsenic in suboxic soils (Ona-Nguema et al. 2009; Wang et al. 2009). While electron transfer between structural Fe(II) and arsenate species is not observed on green-rusts (Wang et al. 2009), arsenate may be reduced by Fe2+ sorbed on micas and clays (Charlet et al., 2005). In case of carbonate and sulfate minerals, the isomorphic substitution of the constitutive anion by the appropriate arsenic oxyanion may enhance the sorption as well (Roman-Ross et al., 2005; Fernandez-Matrinez ert al., 2008). Within the complexity of delta hydrology and chemistry (Métral et al., 2008) it appears that within hundred meters the predominant nano mineral phase changes. These nanoparticle may induce either the trapping of arsenic (by Fe(II/III) oxides and hydroxides and carbonates) in suboxic environments where sandy soils allow a direct vertical recharge of the groundwater, or its mobilization to the groundwater when local impermeable soils lead below in the aquifer to anoxia and where the dominant nanophase (mackinawite) is a poor sorbent. Transition from suboxia to anoxia is further controlled by microbial activity, and the decoupling of Fe and As release is dictated by the solubility of nano ferrihydrite (Burnol et al., 2007, Métral et al., 2008) or of lepidocrocite (Ona-Nguema et al., 2009). The specific reactivity of nanoparticles not only accounts for the difference in As bioavailability within soils and aquifers, but also open new avenues in water treatment and green chemistry.(in Biblography)

The question of exploration of natural surfaces: from minerals to biocolloïds was raised by Fabien Thomas, Jérôme Duval, Laurent Michot, Frédéric Villiéras[12] as follows;

On the surface of the planet, the solid material is transported by water, air, industry, and accumulated in soils and sediments in a finely divided, often in the colloidal domain. In these conditions, processes solid interfaces dominate many environmental phenomena as changes in soil, transfer of contaminants, the formation of biofilms. The last two decades have seen an impressive development of methods analytical local and global giving access to the physico-chemical properties of these systems in different scales, and allowing a rigorous study of the mechanisms at the interface solid-aqueous solution of scales ranging from angstroms to millimeters. With the results of these methods, it is thus increasingly obvious that the heterogeneous and evolutionary nature of natural particulate matter can be taken into account for a rigorous understanding of these processes. Their model is developed in the same direction. Conventional models based on interfaces theories of Langmuir / Freundlich, Poisson / Boltzmann DLVO, Stumm / Healy, Van Smoluchowski, being strictly valid only within a strict framework - diagram of hard spheres and homogeneous smooth - it is essential to adapt to local conditions of strong natural interfaces. So heterogeneity of energy mineral surfaces is quantified by the adsorption of inert gas probes (Ar), polarizable (N2) or interactive (H2O) or aqueous ions, and modeled by the convolution adsorption isotherms of local theory. Regarding the biocolloïdes (bacteria, viruses, humic acids), the concepts of interface, charge or surface potential must be abandoned to those of interphase, filler density, permeability, molecular configuration. The model must then be done by coupling electrostatic and hydrodynamic fields, ionic transport and intra / extra particle. Measures must also be diverse and coupled: electrokinetic, potentiometric titration, diffusion light correlation spectroscopy, fluorescence and AFM etc.. These fine knowledge of the solid-liquid interface are inserted directly into the understanding mechanisms of self-association of natural colloids including the dispersion of clay recentlydescribed as liquid crystals or the formation of biofilms. They are static (equilibrium thermodynamics) or dynamic (transport coupling dynamic and kinetic reactions, chémodynamique

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ecosystems), these studies open up a fieldnew multidisciplinary research and to better understand the reactivity of the particles biological / environmental in the aqueous medium and thus processes such as aggregation, bioadhesion, fixing and bioavailability of toxic.

Before asking the question on the *Sulfide formation and trace metal mobility in floodplain soils* he should honor the ideas of Swiss scientists, Ruben Kretzschmar1, Frank-Andreas Weber, Anke Hofacker, Ralf Kaegi, and Andreas Voegelin and the answers given by Ruben Kretzschmar the five questions on the science.

1 When did you decide to study soil science?
I first discovered my fascination for soils during my undergraduate studies at the University Göttingen, Germany, where I studied agricultural sciences from 1983 to 1985. We had a truly excellent lecture in introductory soil science including several exciting field trips led by Prof. Brunk Meyer and his group. I was most fascinated about the variability of soil properties in the landscape and about how much information one can read from a soil profile, if one understands the processes leading to its formation. During my graduate studies at the University Hohenheim (1986-1989), I developed a special interest in soil chemistry and soil-plant interactions. I was also impressed and fascinated by the lectures of Prof. Ernst Schlichting on tropical soils and by many excellent field trips offered at Hohenheim, including a 2-week trip through southern Spain with Prof. Karl Stahr. After graduating in 1989, I decided to join the Ph.D. program of the Department of Soil Science at North Carolina State University, USA.

2 Who has been your most influential teacher?
There is no short answer to this question, because many different teachers and scientists have influenced my academic development in different stages of my career. My most influential teacher during my graduate studies was Prof. Horst Marschner, who was my Diploma thesis advisor at the University Hohenheim. During the time in his research group I experienced for the first time what it means to be a scientist. I studied the influence of Al-toxicity on growth of pearl millet and other crops in acidic sandy soils of Niger, West Africa. I conducted growth experiments in soil and solution culture, collected and analyzed soil solutions, measured root lengths, analyzed the nutrient status of the plants, etc., and ended up with a large data set to be interpreted. Horst Marschner was a great advisor during this time, because he always listened to my thoughts and gave inputs where needed. During the time at his institute, I learned a lot about rhizosphere processes, plant nutrition, soil-plant interactions, and about conducting research in general. As a PhD student at North Carolina State University, my most influential teachers were Profs. Wayne Robarge and Sterling Weed. Wayne Robarge taught me many important concepts in soil

physical chemistry, while Sterling Weed was a great teacher in soil mineralogy. As a postdoc at ETH Zurich, I further developed my understanding of colloid and surface chemistry working with Profs. Hans Sticher and Michal Borkovec.

3. What do you find most exciting about soil science?
One of the most fascinating aspects about soil science is that it is a truly interdisciplinary science. One can study soils from the viewpoints of chemistry, mineralogy, physics, biology, social sciences, or other disciplines. It's a universe of its own. Also, many soils contain highly valuable information for archeologists, climatologists, and geoscientists. Another exiting aspect about soil science is its importance for nature and human life. Soils are one of the most important and vulnerable natural resources on earth. Practically the entire production of food and fiber depends on fertile soils. Protecting soils from degradation by human activities and global climate change will be one of the greatest challenges in the near future. Soil science can make a big contribution in this respect.

4. How would you stimulate teenagers and young graduates to study soil science?
Students interested in the functioning, management or use of ecosystems will be exposed to soil sciences at some point of their curriculum. At ETH Zurich, my course in *Pedosphere* is mandatory for BSc students in agronomy, forestry, environmental sciences, environmental engineering, earth sciences and biology. In this lecture course, I try to stimulate interest in soils by explaining the role and functioning of soils in supporting terrestrial life on earth. In the following year, we offer a series of soil science field excursions and practical exercises. Field courses are very important, because without them most students perceive soil science as something very abstract. It is important to experience soils in the field early on, because then also the theory behind soil functioning becomes more fascinating. That's at least how it worked for me.

5. How do you see the future of soil science?
At the global scale, food production for a growing population while preserving soil fertility and water resources remains one of the most pressing problems of this century. Soil scientists can make important contributions in this field, both at the fundamental and applied level. Soil science also has an important role in other environmental issues, e.g., protecting biodiversity, predicting global element cycles and the emission or absorption of trace gases relevant for global climate change, improving hydrologic and climatic models, or understanding and controlling the fate of organic and inorganic pollutants in the environment. In all these and other areas, fundamental and applied research on various aspects of soils is essential. There are many exiting opportunities, especially at the interfaces between soil science and other scientific disciplines. Therefore, I think

that soil science does have a positive future. However, we need to convince policy makers that soil science should be given a high priority and that excellence in teaching and research in soil science needs to be maintained.

Concerning the question of the *Sulfide formation and trace metal mobility in floodplain soils exposed by* Ruben Kretzschmar, Frank-Andreas Weber Anke Hofacker[13] Ralf Kaegi, and Andreas Voegelin[14]

During the past decades to centuries, many river floodplain soils in Europe and other industrialized regions of the world have served as sinks for inorganic and organic contaminants released into rivers with urban wastewater and runoff, industry, mining, and other human activities. Such historically contaminated floodplain soils may now release contaminants into rivers and groundwater, even long after the original contamination sources have been remediated. They therefore can pose a continued threat to water quality and ecosystem health. Biogeochemical processes in floodplain soils are highly dynamic, e.g., periodic flooding and drainage induce pronounced soil reduction and oxidation cycles. Our current research aims at a better understanding of the speciation changes and mobility of trace metals and metalloids during redox fluctuations in contaminated floodplain soils, in order to improve predictions of contaminant mobility and toxicity.

Different biogeochemical processes may lead to increasing or decreasing trace metal mobility during prolonged soil flooding. On one hand, reductive dissolution of iron and manganese oxyhydroxides results in a loss of sorbent surfaces and increased concentrations of dissolved Fe2+ and Mn2+ in solution, which may promote the release of sorbed trace metals. Additionally, increasing concentrations of dissolved organic carbon in pore water may contribute to trace metal mobilization. On the other hand, trace metals also may be immobilized as a result of rising pH and by formation of poorly soluble sulfide minerals during sulphate reduction. The potential for trace metal immobilization by sulfate reduction, however, depends on the concentrations of sulfide-forming trace metals and of available sulfate present in the soil. The amount of sulfate in river floodplain soils can become the limiting factor, in which case formation of the most insoluble metal sulfides (e.g., CuS) may consume all available sulfide, leaving other chalcophile metals in more mobile forms. Furthermore, recent results have shown that prolonged soil flooding may also lead to the formation of sulfide nanoparticles and colloids in the pore water, which may be mobile and

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thereby increase metal mobility. In this presentation, our recent research on metal mobility in river floodplain soils will be presented and discussed.[15]

In light of the statement of Swiss scientists, we should raise the issue of contamination of land south of Kurdistan chemical where weapons were used by Saddam Hussein and chemical findings on the health of our people, and use of biological and bacteriological weapons by the armed forces of Turkey and use of chemical and biological weapons against the combatants of the Workers Party of Kurdistan and PhosfoR bombs thrown by the Turkish army on our forests in northern Kurdistan and know what is the *Mineral-organic-microbe interfacial interactions: environmental impacts from molecular to macroscopic scales* on Kurdistan, without forgetting the East Kurdistan side of Persia and chemical weapons used by the reactionary Iranian mullahs and scholars answer the following On this issue the English scientist David J. Vaughan[16] thinks that
Human activities now have an unprecedented impact on the materials and processes at or near the Earth's surface, in the so-called 'critical zone' which is essential to all life. Here, where the lithosphere, hydrosphere, atmosphere and biosphere meet, processes at interfaces play a key role on scales from molecular to global. A particularly important interface is that where the mineral surface can interact with organic molecules, biomolecules and microbes. At this interface, microorganisms play a critical role in promoting electron transfer (redox) reactions, which may lead either to the solubilisation of minerals or to their precipitation. Microorganisms also produce the extracellular polymeric substances ('biofilms') that may coat mineral surfaces, or form in fractures or the pore space of sediments, thus influencing reactivity and fluid flow.
In this presentation, mineral-organic-microbe interactions will be considered, particularly with regard to examples such as iron oxide mineral surfaces and Fe(III) reduction. The overall controls exercised by specific mineral substrates, the molecular scale mechanisms which can involve compounds acting as electron shuttles, and the further impact of microbial iron reduction processes on the geochemical behaviour of a range of other elements will be considered. The development, nature and importance of biofilms will also be discussed, and their roles both in creating local environments to allow precipitation of dilute dissolved impurities from circulating fluids, and in controlling the flow of such fluids. Experimental studies of biofilms will be described, ranging from imaging of interstitial and simulated fracture-filling biofilms at the micron-scale, to

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mesoscopic scale column experiments, and to macroscopic (field) scale studies of the hydraulic conductivity of unconsolidated sediments.

We know that regulate development of nanotechnology requires evaluation work particularly impacts on ecosystems. This work is still underdeveloped in the world. At first it appears that properties that play an important role towards the disturbance of biological activity are strongly dependent on the size of the dispersed nanoparticles in natural environments. These properties are mineralogy (eg TiO_2), the crystallinity and surface reactivity which affect the toxicity or via the redox potential (Fe °), or by the release of toxic cations (Cd, Zn), structural changes Fe_2O_3, Fe_3O_4). and transport of contaminants proven (The biological effects will then depend mainly the formation of oxidizing species oxygen entrainant oxidative stress. The answer does not always seem to be correlated to the surface specific (CeO_2). The dissolution of metal oxide nanoparticles is causing significant toxicities on micro-organisms. Cations from this solution (Zn, Cd, Ag) are known for their toxicity. Of surface formulations may reduce or delay their dissolution in aquatic environments. The silver nanoparticles a few nanometers with a surface dominated by the faces (111) penetrate within bacteria and react with sulfur and phosphorus. In fact, questions concerning the role of size with respect to the responsiveness are still wide open: - For example is it that the appearance of catalytic properties interferes with electron transfer in the respiratory chain?
- Is the production of oxidizing species depending on the size of nanoparticles enhances DNA breaks?
Does the strong increase of specific surface area below 30 nm can cause inactivation of protein adsorption? Is there a relationship between size and the inflammatory response and genotoxic? Finally, if the studies focus on nanoparticles "laboratories", nothing is yet known about nanoparticles from materials widely available and are brought into contact with aqueous media to deconstruct. This issue was raised at the Symposium of the Academy of Sciences which was the subject of the paper entitled Nanomaterials and nanoparticles:

Disturbance of biological activity in the environmental sphere, it seems that the intervention of Jean-Yves Bottero; Jerome Rose; Melanie Auffan; Celine Botta; Jerome Labille[17]; Masion Armand, Antoine Thill [18] Laila Benameur , Alain Botta , Michel De Meo [19]; Chaneac Corinne, Jean-Pierre Jolivet[20]

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had opened a path for other researchers who worked on Lake Van, and I thought the disappearance of Lake Ourmieh Eastern Kurdistan. Thus the question Nanomaterials and nanoparticles: Disturbance of biological activity in environmental setting was asked.

As the river valley sacred Munzur Lake Ourmieh von away with such a life in Kurdistan millennium for a nation that is not free. As my people under the bombardments of napalm and chemical weapons and biological nature of my country has been a cultural genocide ecological and archaeological heritage of all mankind in our century and centuries of the future. The ideas of scholars ed Academy of Sciences for the sacred river of Munzur and will ask my questions and I am informed this matter to the world public opinion and lead scientists, academicians, scientists from all over the world. Karim Benzerara, Georges Ona-Nguema, Jennyfer Miot, Guillaume Morin[21] who worked on Lake Van think, *significance mechanisms and environmental implications of microbial biomineralization processes* Microorganisms can form minerals and impact subsequently the geochemical cycle of many different elements, including pollutants. These biomineralization processes can be indirectly triggered by the metabolic activity of microorganisms and the resulting chemical shifts in their

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surrounding microenvironments. Moreover, nucleation and growth of mineral phases can be impacted by microbial surfaces. Finally, biomineralization processes may sometimes be genetically programmed. Although these questions are ancient, we still poorly know the diversity, the significance and the impact of the microbial mineralization processes in the environment. The new tools that are now available in the field of mineralogy, geochemistry and microbiology however offer the opportunity to improve significantly our understanding of these processes. Here, we will present a combination of field and laboratory-based studies illustrating how bacteria can form minerals. We will first review the study case of the Carnoules acid mine drainage (Gard, France) where microorganisms and associated organic polymers have been shown to impact significantly the sequestration of arsenic in sediments by forming biominerals. Then, we will give an overview of the diversity of biomineralization patterns that can be observed in the environment, illustrating some of the mechanisms that are involved in the precipitation of mineral phases by bacteria. This requires the use of cutting-edge microscopy and spectroscopy techniques which still need further improvements. Finally, we will present the crucial information brought by laboratory experiments focusing specifically on iron biomineralization induced by Fe(II) bacterial oxidation at neutral pH under anoxic conditions. In particular, we will show that in some cases, biomineralization occurring at the contact of microbial cells leads to their entombment in minerals and thus fossilize them. This questions the impact of biomineralization on the viability of microbes and the subsequent evolutionary pressure that it might exert on microbes. Alternatively, it forms nano to microscale objects that might be preserved in the geological record opening promising perspectives for the study of the history of life and biomineralization.

The question of *Crystal-chemistry of iron and aluminum in tropical environments: formation and degradation of the soils in the Amazon basin examined by* Emmanuel Fritsch, Étienne Balan[22] By its surface, its location in the tropics, its diverse coverage and alteration Considerable quantities of materials exported to the ocean, the Amazon Basin region is emblematic both from the perspective of understanding the operation of the Geochemical Earth's surface, as in that of sustainable development. The surveys undertaken in the project Radambrasil (1978) showed that there was an orderly distribution of soils across landscapes and also ordered distribution of these landscapes across the basin. However, the mechanisms and chronology of the process leading to the orderly distribution remain poorly understood. To predict the evolution of Amazonian soils, it is now essential to identify what processes are still active today and linking process old archived in mineral transformations geodynamic

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and paleoclimatic changes affecting the basin as a whole. The structural and mineralogical studies conducted on sites representative of major environments hydro-bio-geochemistry of the basin have revealed the major processes (laterization, waterlogging and podzolization) have acted in different compartments of these landscapes.

In compartments drained lateritic best, crystal-chemical study of secondary minerals, mainly clays and iron oxides, can identify multiple generations coexisting in the same profile, to determine the physicochemical conditions prevailing during training, and in some cases to prove their age. Expanding compartments and hydromorphic podzol in these lateritic formations is attributed to the more recent development of systems and groundwater acidification. These processes operate predominantly in the central and upstream basin, corresponding to the most rainy. The remobilization of elements previously accumulated (mainly Fe and Al) is particularly active in the weathering front side located at the transition between soil compartments, and indicates the topicality of the processes involved This multiscale approach allows to situate the soil systems studied in a more global geodynamics, assigned to the history of the basin, and to better understand the place of tropical systems in the evolution of continental surfaces.

The two scientists Sabine Petit, Dominique Righi [23]believe that Significance and role of clays in soils: use of recent experimental data, is very important and significant in terms of scientific research In soils, the transfer elements are controlled by reactions at the interfaces between mineral constituents, organic and biological. The clay minerals by their properties largely govern these reactions. With a cation exchange capacity (CEC), they play an important role in controlling the flow of cations. They also help neutralize the natural acidification of soil saturation of CEC by the protons released during the soil-plant interactions. However, it is shown experimentally that by altering the H +-smectites are not stable and that the pages whose interlayer spaces are more accessible are selectively dissolved, the chemical composition of the octahedral layer also involved. Thus, in soils moderately alkaline very clay-rich smectites (Vertisols of Italy), detailed analysis of the value and location of the charge sheet of the smectites suggests a quick selection of minerals whose crystal chemistry is the best adapted to the geochemical conditions prevailing in the different soil horizons. While the CEC and expense sheets available clays are identical, the location of charges is different in different horizons. Only smectites at high tetrahedral charges are present in the upper horizons.

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Under the conditions of soil montmorillonites (inherited from the sediment) are unstable, they disappear in favor of beidellites high load. The experiment confirms the preferential alteration of dependent octahedral clays (montmorillonite). A "illitisation" apparent is observed, caused by the binding of K and the irreversible closure of part of the interlayer spaces of beidellites high load. The impact on the behavior of these soils are important because they progressively lose their ability to interchange. Furthermore, to predict (or reconstruct) the functioning of soil, it is appropriate to use the crystal-chemical characteristics of clay minerals if at the same time, it captures their process of formation and transformation. The relationship between the crystal chemistry of clay minerals and their training requirements are difficult to establish the study of natural minerals, and speculative, because too many parameters involved are crucial. In simple systems, the syntheses mineral can specify how environmental conditions induce the formation of minerals with crystal chemistry or crystallinity particular: for example the negative effect of pH paper on the crystallinity of kaolinite has been clearly demonstrated. By cons no link could be observed between the iron content and structural crystallinity of these minerals. Work in progress also emphasize the role of pH in the crystal chemistry of smectites synthesized especially in the Al-Fe system.

The Effects of Iron Redox Cycles on Smectite Properties examined by Joseph W. Stucki,[24] The oxidation state of structural Fe in expandable clay minerals is known to assert a significant influence on the chemical and physical properties of these ubiquitous soil constituents. Because redox cycles in nature are common, the current state of an Fe-bearing clay mineral in the soil is determined by how it has responded to such cycles. In this presentation the changes in chemical and physical properties of smectite due to single and cyclic redox events will be reviewed. Studies have shown that reduction of structural Fe(III) to Fe(II) increases the cation fixation capacity of smectite. If K+ is the exchanged cation, reoxidation only partially reverses the fixation and some of the Fe(II) is precluded from reoxidation. Further redox cycles continue to increase the residual Fe(II) and fixed K+ in the reoxidized state, giving the smectite an illitic character. Other changes also occur within the 2:1 layer of the smectite that may be irreversible, including partial dehydroxylation and solid-state cation migration between *cis*- and *trans*-octahedral sites. The reversibility of these changes depends on the extent of reduction. Macroscopic properties affected include cation exchange capacity, specific surface area, mineral solubility, and swelling in water. Knowing the dependence of these chemical and physical properties on redox cycles provides information from which a more complete historical record of soil formation can be constructed.

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For Rodney C. Ewing,[25] think that scientific thought and technical on *The "Back-End" of the Nuclear Fuel Cycle: Role of Mineralogy for the Safe Management of Nuclear Waste* is very important. The disposal of fission products and actinides generated by the "back-end" of the nuclear-fuel cycle is one of the major challenges in environmental sciences for the 21st century. Because some fission products (*e.g.*, 99Tc, 129I, 79Se and 135Cs) and actinides (*e.g.*, 239Pu and 237Np) are long-lived, they have a major impact on the risk assessments of geological repositories for nuclear waste. Thus, demonstrable *long-term* chemical, radiation and mechanical durability are essential properties of waste forms for the immobilization and disposal of radionuclides. Mineralogical and geological studies, so called "natural analogue studies," provide excellent candidates for long-term immobilization and a unique database that cannot be duplicated by a purely materials science approach. This "mineralogical approach" is illustrated by a discussion of pyrochlore as a phase for the incorporation of transuranium elements into nuclear waste forms and inert matrix fuels.

Since the discovery of Pu in 1941, more than 1,800 metric tonnes of Pu, and substantial quantities of the "minor" actinides, such as Np, Am and Cm, have been generated in nuclear reactors. Some of these transuranium elements can be a source of energy in fission reactions (e.g., 239Pu), a source of fissile material

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for nuclear weapons (e.g., 239Pu and 237Np), and of environmental concern because of their longhalf lives and radiotoxicity (e.g., 239Pu and 237Np). In fact, new strategies for the advanced nuclear fuel cycle are, in part, motivated by an effort to mitigate some of the challenges of the disposal of these longlived actinides. There are two basic strategies for the disposition of these elements: 1.) to "burn" or transmute the actinides using nuclear reactors or accelerators; 2.) to "sequester" the actinides in chemically durable, radiation-resistant materials that are suitable for geologic disposal.

There has been substantial interest in the use actinide-bearing minerals, such as isometric pyrochlore, A2B2O7 (A= rare earths; B = Ti, Zr, Sn, Hf), for the incoropation of actinides, particularly plutonium, into nuclear waste forms and inert matrix fuels. Systematic studies of rare-earth pyrochlores have led to the discovery that certain compositions (B = Zr, Hf) are stable to very high doses of alpha-decay event damage. The radiation stability of these compositions is closely related to the structural distortions that occur for specific pyrochlore compositions and the electronic structure of the B-site cation. Recent developments in the understanding of the properties of heavy element solids have opened up new possibilities for the design of advanced nuclear fuels and waste forms.

Role of mineralogical processes in the geological CO2 storage exposed by François Guyot,[26] A large scale geochemical cycles, the earth's atmospheric CO2, continuously produced by internal geological activity is naturally stored mainly in the form of carbonate minerals: silicate weathering by water acidified by CO2 leads to the formation of ions that precipitate when saturation with respect to the solid is reached. The solid carbonates thus formed are then integrated into a geological cycle length and remain stable for several tens of millions of years, making the mechanism attractive for permanent sequestration of CO2 excess. However, the scale of the injection and geological storage of CO2 envisaged in the coming decades in different tanks to mitigate the environmental impact of the anthropogenic increase of atmospheric CO2, the intrinsic kinetics of silicate weathering and in some cases the precipitation of carbonates, making these incremental process. This difference strongly affects the perception of the reliability of this future technology: mineralogy therefore exerts an important mechanistic control on this very current environmental issue. The mineralogical factors kinetics of dissolution of silicate and carbonate precipitation, studied in the laboratory by several groups, particularly in France (Grenoble, Montpellier, Nancy, Paris, Toulouse, non-exhaustive list) are presented and the dissolution of silicates is generally identified as the major

[26] **François Guyot**,[26] Université Pierre et Marie Curie, Institut de minéralogie et de physique des milieux condensés (IMPMC), Paris

limiting step. We show that this limitation is related to the development of amorphous silicon layers more or less passive on the surface of silicates, the question of predicting the degree of passivation in a given condition, due to impurities in the layer which alters the microstructure, Left wide open. During the dissolution process, the deviation from equilibrium thermodynamics has a significant effect on the structure of the surface of minerals, and thus their dissolution kinetics, an effect that is just beginning to be examined carefully by using new methods records available, in particular the coupling between Focused ion beam (FIB) electron microscopy and analytical transmission. In some cases, the kinetics of precipitation of carbonates in turn can become the limiting factor of the process, mainly formed when minerals are dolomite, ankerite, magnesite or siderite. From this perspective, the process of biomineralization in the biosphere groundwater, initially present at sites of geological storage or imported, may play an important role and are just beginning to be discovered and studied. Examples of research on these problems will be presented.

Dr Ali KILIC, Paris, 14 09-2009

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