Dossier

Volcanoes, Landscapes and Cultures
Bio-fuels: the Jatropha Curcas
the State of the Art

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Content

Editorial 5

Dossier: Volcanoes, Landscapes and Cultures

Living Landscapes. Lava presences in the city of Catania
By Simona Calvagna 6

Identification and preservation of geoheritages by creating geoparks and development of geotourism. Case study: Dorafk and Deylaman no hunting zone (province of Gilan – Iran)
By Saboory Tahereh and Roya Mousazadeh 12

Guan Chenech; the Canary Islands and Guanche Culture
By Maria Ilaria Panaccione, Fabrizia Buongiorno and Sergio Barrera Rodriguez 19

The of volcanic topography on Etruscan Culture
By Ann C. Pizzorusso 28

Volcanic Small Islands in Japan: restauration, risk management, volcanic tourism. A case about Miyakegima Island, Japan.
By Yuki Sato 37

The Myth of Mount Etna: between cinematography and literature
By Caterina Cirelli and Enrico Nicosia 41

Conserving the Cauve Pueblos in the Volcanic Landscape of Bandelier National Monument
By Angelyn Bass Rivera 47

Volcano and Geothermal tourism: Recreation or Adventure?
By Patricia Erturt Cooper 53

Islanders at Work
The Galapagos Islands. Preservation of Life: an obligation for contemporary architects
By Veronica Zabala 59

Insula’s page 12

Book Review 64

Editorial

Man and Volcanoes, Landscapes and Cultures

Surprising coincidence! While we were preparing the present issue of our Journal dedicated to Volcanoes, the Eyjafjöll in south Iceland suddenly decided to shake off the Glacier lying since long peacefully on his shoulders, blowing up to the skies ashes, smoke and steam, thunders and lightnings within a huge cloud nailing down on their airstrips half of the world aircraft.

An unprecedented disaster, uttered an ill-prepared and shocked governmental spokesman. A meaning full « Act of God » whispered an other devout ecologist, while tens of thousand travellers scattered here and there, were complaining the consequences of the obscure mineral turbulences of a minor Icelandic volcano.

Yet, following well informed specialists the Eyjafjöll’s is a minor eruption. Just a sneeze, so to say if confronted with the 1883 explosion of the volcano located on the Krakatoa Island between Java and Sumatra. 40,000 People lost their livies, while the column of ashes raised up to the stratosphere generating a cloud that produced considerable climatic and meteorological consequences for more than one year, all over the planet.

Yet, unexpectedly, the Krakatoa eruption was also at the origin of a surprising growth of visual arts. During Autumn 1883 strange phenomena took place: the moon appeared blue or green colored; the firemen in New York or elsewhere believed to notice huge fire burning, while it was ashes in the stratosphere reflecting sun rays. Such sunset lights were definitely remarkable. Purple, passion-red, salmon, amber dyed the skies and attracted artists and painters wishing to capture such atmospheres.

A talented London Citizen fascinated by the beauty of the night-sky over the Thames, decided to illustrate the quickly changing sky-scapes by painting a water-colour every 10 minutes. More than 500 paintings resulted from his efforts.

Recent studies suggest that Edward Munch painted his « Cry » after the eruption recalling a night in Oslo particularly charged with volcanic ashes. Climatic records confirm that the orange curbs appearing on the canvas behind the horror distorted face correspond exactly on that winter night sky over south Norway.

Beyond fine arts Krakatoa’s eruption contributed also to science advancement. Micron sized ash particles did not fall again on earth, they took on the contrary altitude and travelled for years around the globe, lited by winds unknown at that time. Observers scrupulously noted the sky colors upon certain cities in relation with high altitude winds and established maps describing the circulation of these powerful air streams that were later called Jet-streams.

There are many more ancient and recent records of volcanic turmoil's indicating their toll of human lives and often devastating impact on bio-diversity, human settlements and artefacts. Man kind, nevertheless was since ever attracted by these "mountains of fire" appreciating their fertile slopes while respecting their divine strength and thunderous voice. Nowadays volcanic shivers and dramatic landscapes pervade cinema, literature, photography and several scientific disciplines. Obviously authorities and planners are concerned with civil protection more so because volcanic landscapes, erupting or not are becoming worldwide appreciated tourism destinations. Recalling also that volcanoes are often islands we believe that there is enough reason to justify the subject matter of our Journal’s present issue.

The contributing authors explore here only a few of the many realities represented by the world of volcanoes, a fascinating overlapping nevertheless, of these uncanny giants, capable when raising their voice, to stop the airplanes of half of the world.
Living landscapes. Lava presences in the city of Catania

By Simona Calvagna

«Landscape marks a determined part of the territory as it is perceived by inhabitants, and its character derives from the action of natural and/or human factors and their interrelations» (1).

The leading actor in the genesis of the landscape is man, in that he is the only subject capable of reproducing – by means of a representation – the perception of the relations that he himself has with the environment. The emphasis on the perception of relations between man and environment denotes an interest in the physical dimension of space as well as the virtual dimension of its representation; the concept therefore assumes an ambiguous character, being intimately linked to material space and immediately projected towards the transcendence of its representation (2).

If it is possible, as emerges from some research, to identify also a materiality of landscape (3), its immaterial dimension – which a representation is – consists of the totality of relations between society and nature (which can be of various orders: affective, aesthetic, symbolic, sensorial, phenomenological), which are always governed by pre-existing cultural and/or artistic models. It is possible to identify such models among the 'canonical' representations of landscapes realized in art(4), during its evolution the 'cultured' value of landscape representation lost its pre-eminence, giving way to the idea of a socio-cultural determination, even though the conviction that no landscape could ever exist without the human gaze to observe it remains fixed. This way of seeing has become 'democratized' and alongside the cultured gaze, expressed in an aware and knowing manner by intellectuals, artists and designers, there is now the living gaze, the way of seeing of man observing.

The strong relational and perceptive component emerges in the analysis of a well defined type of landscape that is present in the city of Catania, that landscape which has, as protagonists of the interaction first evoked, the population of Catania on the one hand and its volcanic lands in their natural state on the other. Observing these relations is equivalent to proposing a reading of Catania and its possible landscapes in relation to the presences that are intact, intact, visible and apparent of a soil with a strong morphology and dynamics, but also in relation to the 'civilized' presences of the same soil, the result of the transformation of matter into construction material. The present research is a part of a more wide-ranging work (5), that starts from a careful survey of lava outcrops within the urban fabric and moves towards an enquiry (qualitative)(6) about the perception of the lava presences by the inhabitants settled there. Attention is paid to the formal expression of man-volcanic ground relations, analyzing in particular the landscape planning dimension and achieving a definition of living landscapes according to the level of depth and activity of the relations that man has with these lands.

The system of volcanic open spaces in the city: the urban sciare

The growth of the city has made it increasingly difficult to understand the various stratifications of lava flows that have enveloped Catania's history. If in the eighteenth century Catania was known to cultural elites as the city of the volcano – due to its geographical proximity to Etna, the widespread presence of volcanic material that gave character to its spaces, its colours and its surfaces, together with the plano-altimetric conformation – today the city has left very little of the volcanic nature of its lands visible. The areas that have been saved from the burgeoning urban growth that has taken place over recent decades on the south-eastern slopes of the volcano, forming the conurbation of Catania's metropolitan area, represents a system of fragments of natural (volcanic) features spread throughout a territory that has been greatly anthropized. These spaces, by their very nature, have the morphological and biological features of the sciare (volcanic fields) that are found in the Etna context. Despite this fact, they also possess an 'urban' character, granted by their surroundings: the volcanic outcrops are nested throughout the urban landscape, emerging as natural elements within an artificial environment. The same presences are somewhat indistinct in the less anthropized places on the slopes of the volcano, but here in the city they assume a different identity in that they are in relation with a different reality, absorbing in part its character, but still preserving a certain autonomy. The urban spaces with a strong volcanian component exist as interstitial spaces trapped within the urbanization, residual fragments of anthropic construction with no pre-ordered planning. They can be compared to what the Stalker urban artists define as Territori Attuali (Actual Territories), declining this definition according to the specificity of the volcanic nature of the place: «They constitute a negative of the constructed city, a mix of internal and external, man-made and natural, structures, the dark side of the cities, the spaces where the organic and the inorganic, nature and artifice, clash and contaminate each other. Here nature's metabolizing man's waste produces a new horizon of unexplored territories, mutating and effectively virgin» (7).

Reflections on the relation with the ground of architectures on volcanic lands

In seeking to investigate the repercussions of the presence of the volcano on the architecture of the city, be it ordinary or special, two main paths of research appear. On the one hand there is the path linked to the stone material as a base for construction, and in this regard there is a weave of technological - constructional reflections together with typological-formal considerations; on the other there is the path concerning the buildings' relation with the ground, where areas of refuge for bio-diversity, incubators for the future of marginal species, which can be traced to the concept of the Third Landscape created recently by Gilles Clément: «Fragments indécis du jardin planétaire, le Tiers paysage est constitué de l'ensemble des lieux délaissés par l'homme. Ces marges constituent une diversité biologique qui n'est pas à ce jour répertoriée comme richesse» (8).

Fig. 1. The healing plant building in the Monastery of San Nicolò l'Arena, designed in 1994 by Giancarlo De Carlo on the terminal outcrops of the 1669 lava flow.

The system of urban volcanic spaces, which together with the emerging outcrops of rocks, ridges and rocky bases constitutes the widespread presence of the volcano in the city, contains within itself everything that has taken place in the current social construction, everything that has been rejected by man, and as such it defines a grouping of marginality. And precisely this is perhaps the most special feature of these places: they are beyond the control of man and they welcome everything that is elsewhere rejected, becoming...
monastery stands and the level of its immediate surroundings, producing a sort of trench of which the lava flow constitutes one side, opposite the façades of the building. The rocky wall that delimits the Giardino dei Novizi to the south, and which stands before a secondary façade of the monastery complex, has been subjected to the most interesting intervention from the point of view of the relationship between architecture and volcanic ground. The rocky wall, featuring a compact and faceted lava front – the brutality of which is best appreciated in the early morning when the sunlight amplifies its contrasts – is attacked by a structure that seeks to dialogue with it: «The heating plant building leans delicately on the wall of a lava flow, and is thus a standard bearer for geology, which is Catania’s soul» (11).

If on one hand there are in the city no other examples of architectures that are the product of an informed and cultured planning process, the spatial and ideological poignancy of which draws on the volcanic land on which they stand, on the other hand the spontaneous architecture of the lesser city, from the beginning of the twentieth century, offers us a rich inventory of examples of relations with the ground. This part of the city was built on the most impervious lands, which were therefore less attractive to the wealthier classes. Furthermore, given that the costs of earth moving were prohibitive and the means for this type of work were difficult to find, it became difficult to ‘eliminate’ the volcanic obstacles and so it was necessary to invent ‘means’ of living with them. In this spirit of competition between man and nature the solution experimented was always geared towards the saving of energy (economic and physical), which was translated into maximum integration of the building with the site. This was achieved by respecting the difficult nature of the land and by transforming its harshness into a wealth of ideas, suggestions, spatiality. The range of project solutions displays an infinite variation on three main themes:

- the spatial means of access;
- the altimetric organization of internal space;
- the spontaneous volcanic garden and its relations with internal space.

Naturally this phenomenon was not limited to the western area of the city, but wherever there were considerable differences in height due to a lava stratification built up over successive periods. The areas in which these conditions existed were therefore, as well as the area to the west of the centre, those to the east, corresponding to the great mass of lava that Sciusc Paitti called Larnisì (12); it was in this direction that the city was to extend most substantially from the beginning of the twentieth century.

The interaction between buildings and nature was realized through the integration of varying levels in the architecture. The irregular lie of the land is respected by the movements in the base of the buildings, with discontinuity and varying levels in the flooring, overcome by means of small flights of steps, with the consequence that interior spaces with different heights are created and resolved in a discontinuous way. This occurs not only in buildings, but also and above all in the open spaces linked to the interiors. The Arab house is present as a spatial framework among these types of habitations, all of which are geared towards protected exteriors, often ‘secret’ areas, always including luxuriant vegetation that is both autonomous and wild, as the special climatic and pedologic situation requires.

The spontaneous garden is always created under the control of a difference in level, with a rocky wall colonized by capers, prickly pears, etc., to greater or lesser degrees. This wall can be in contrast with the building, it can dominate it, it can be a base, it can support the garden itself (hanging garden) – there is an infinite series of real examples.

With advances in the technology of building processes and the relative reduction in the costs of some work, there has been a homogenizing in construction. This phenomenon has brought a corresponding loss of the special nature of the ground-building relationship, becoming a purely technical problem, which can be easily resolved with the elimination of the harshness of the land in favour of a levelling of the city at a pre-established height level. Nevertheless, there are some exceptions to this widespread approach, and some undoubtedly evocative lava presences have been preserved in relatively recent buildings – small exceptions to an inexorably general rule.

The volcanic gardens

We can identify a cultural model for landscape design of free areas with important volcanic presences in the garden that carried the name Villa Scabrosa, and which no longer exists today. This garden was promoted and created by an exponent of the city’s aristocracy, Ignazio Paternò Principe di Biscari, during the century in which throughout Europe there was a process of ‘volcanization’ of landscape.

It is of considerable interest in the construction of the concept of Etna volcanic landscape in that it can be considered as the first example of artificalisation in situ (13). The project gave emphasis to the material’s strength and the contrasts that existed in these hostile territories, planning and reconstituting artificially the natural and slow processes of erosion of the lava by the spontaneous vegetation. The modernity of the project lies in the intuition of recognizing – in these places rich in signs, symbols and recent memories of destruction – the fascination of the superfluous; in the detachment that is the result of the contingency of the difficulty in access, the harshness, the dark colour, the result of all those negative qualities that gasped these places the common name of horror. The modernity also lies in the foresight that arose from this detachment – making a pleasure garden of what had been a dead desert, substituting the sentiments of hostility with the quest for beauty, for aesthetics.

The garden of Villa Scabrosa can be considered as an exception to what has been the usual development in the planning of green spaces in Catania up to the present day. A mute interaction between human settlement and the volcanic land generally characterized the development of the city, especially following the war, with the consequent contemporary abandonment of these areas, now left to themselves, and even, more seriously, used improperly as rubbish tips or unauthorized quarries.

The only true volcanic park of the city is the Parco Giosuè, created in 1994. The focus of the project is addressed entirely towards the wild nature of the vegetation and the conformation of the land, the natural expressions of which rise to become structural elements of the project. The volcanic ground is considered as a characteristic element and therefore as an element to be safeguarded: the idea of the geologist who, as a figure external to the conception, envisaged a volcanological museum in miniature, thus finds its realisation in the choice of making the volcanic presences the protagonists of the place, in close attempt with the spontaneous grass and bush vegetation, in an attempt not so much to build an aesthetic and formal model, as to protect the existing biodiversity (14).
read and influential biophysical and material dimension that at least momentarily receives no attention from the population.

All this, in the context of our theoretical approach, leads us to grant to the landscapes that are born from the relationship between the population and the lava outcrops the status of crucial embryonic landscapes. Their biophysical dimension is evident, and even if the tendency has always been towards suppression, today they remain an important presence. Indeed, despite the apparent indifference of the population, there certainly exists an immaterial dimension linked to them: memories, fears, prejudices linked to the lava... these are signs of a sensitivity towards a natural environment, the lava environment, which in its immediacy imposes itself as fascinating and wonderful. In truth there is a lack of awareness among the population of their own position with regard to this aspect of the city's appearance.

It is clear instead that the invention and the life of Etna's volcanic landscape are existing and visible realities, founded on the vital contrasts and tensions between opposites. The people who settled on the foothills of Etna could not fail to invent the volcanic landscape, because this feature was too strong and dynamically active not to be perceived. The volcano is always animated by a world of meanings, legends and myths connected with itself, and these have enjoyed as their backdrop a nature observed by man -modified, deciphered, used.

The terms of the comparison change in passing from nature to the city: the passage is from the man~volcano relationship to the man-volcanic land relationship. Evidence of the relationship is obscured when, in the binomial man-nature, the volcano itself, personified and mythologized, is substituted by the volcanic land, in particular the urban variety. It is the human and artificial dimension that supercedes the natural one: the lava of the city is no longer nature, it becomes something else. The denaturalization of the urban lava flows can be traced to the dynamics that have accompanied the transformation. The volcano caused the destruction of the city with the heartquake of 1693, but some thirty years previously it had provided the material for its reconstruction: the lava flows of the 1669 eruption were quarried intensely and were the main source of materials for reconstruction. What remains today of these lava flows and the even older ones can be seen as the forgotten wreckage of something that instead has been the soul of the city in having allowed its existence. Thus the volcanic land began already to lose its naturalness in the very moment in which it was seen and used as a material, acquiring in the popular imagination a utilitarian connotation that went beyond nature. What remains today is only that part of the city that has not been transformed by man in the city, what remains is in its raw state and therefore represents places that are unfinished.

Perhaps it is in this very feature of the unfinished, of missed potential, of movement towards a goal that has not yet been reached that there lies the salvation of these spaces: if indeed the reason for the lack of organized relations (which would have been capable of animating the landscape of the urban lava flows) does not relate to the lack of tensions (which would be equivalent to death in thermodynamic terms) but on the contrary relates to the unresolved nature of tensions that are present, then this means that the landscapes of these places are possible. If, on the one hand they are unfinished because the only significance that up until now has been given to them has been that of raw material for the construction of the full city, on the other hand they could become finished in the moment in which another significance can be conceived for them, linked rather to the empty part of the city. The evolution of these embryonic landscapes depends therefore on the population's capacity to transform the abandonment and the unfinished nature of these places and the random and disorganized presence of these outcrops into heritage: the capability to do this starts from an awareness of their presence and continues through the care of and the falling in love with these places.

4. «Notre regard, même quand nous le croyons pauvre, est riche, et comme saturé d'une profusion de modèles, latents, inévités, et donc insoupçonnées: picturaux, littéraires, cinématographiques, télévisuels, publicitaires, etc., qui ouvrent en silence pour, à chaque instant, modérer notre expérience, perceptive ou non. Nous sommes, à notre insu, une intense forgerie artistique et nous serions stupéfaits si l'on nous révélait tout ce qui, en nous, provient de l'art. Il en va ainsi du paysage, l'un des lieux privilégiés où l'on peut veiller et mesurer cette puissance esthétique.» (A. Roger, Court traité du paysage, Gallimard, Paris 1997).
5. The present paper comes from the revision of the author's Ph.D thesis with the title «Living landscapes. Presence of lava in downtown Catania». The thesis was in Geography (University of Paris I Panthéon-Sorbonne) and in Architectural, Urban and Environmental Project (University of Catania), thanks to a co-tutoring doctorate between Italy and France.
6. It's a methodology that aims to find the ideas present in the answers of the sample interviewed and not their statistic recurrence.
7. In the case of the city of Rome, studied and crossed through by Staller, we cannot talk simply of a radial city with a system of cuneiform spaces, similarly for Catania we cannot talk of a city regulated by a system of anti-seismic axes and open squares functioning as assembly points, rather the form of the city is closer to a fractal archipelago in which the built-up area constitutes a terra firma immersed in a sea of spaces that are very much diversified, hybrid, difficult to trace back to controllable geometries.
Identification and Preservation of Geoheritages by Creating Geoparks and Development of Geotourism
Case Study: Dorfak and Deylaman no hunting zone (the Province of Gilan-Iran)

By Sabouri Tahereh and Roya Mousazadeh

Abstract

Iran enjoys a great variety of geological and geomorphologic phenomena. From the viewpoint of biodiversity and historical and cultural attraction, Iran is the 5th and 10th country of the world respectively, and also is in an appropriate stage for developing tourism especially in ecotourism and geotourism sectors. The aim of this article is identification of nature of geological and geomorphologic phenomena prone to tourism planning and recording of existing potentials for zonation. Dorfak and Deylaman No Hunting Zone is a prominent symbol of diversities of natural phenomena, geological heritage and geomorphologic forms such as karst landforms and other cultural landscapes in Gilan. Highlands of Dorfak & Deylaman show geological evolution and an untouched nature, traditional settlements and cultural development of local communities in this area. If the geopark is a place prioritized by scenic geological landscapes in a touristic site containing human resources, environmental factors and history of a nation, establishment of Dorfak & Deylaman geopark could be an applicable idea to protect peerless karst landscapes and environmental and socio-cultural structures in the study area. In addition to scientific, aesthetic and historical views a tourist can observe karstic evolution in a vast landscape made of crushed lime materials, arid valleys, dolins, lapies, picturesque poljes on Dorfak peak, caves, stalagmites, stalagmites, gophers, etc. This research discusses on establishment of Dorfak & Deylaman geopark as a prioritized option by evaluating geotouristic potentials of the area particularly karsts and suggests guidelines for protection and sustainable development of caves and karsts.

Key words: Geology, Geomorphology, Geopark, Geotourism, Development, Dorfak & Deylaman

1. Introduction

Today, much attention has been paid to modern methods in providing tourist attractions by managers and authorities in developing countries. Methods that in addition to making incomes can prevent environmental degradation and help develop local communities. A new method of geotourism is selection unique geosites in a country. "The environment is the medium for interaction of human and nature and running development plans would be a waste of time as long as no precise information is available about the environment and its parts" [1]. In the present study, geomorphologic studies were carried out in Makhdoom model of land use planning of Gilan. Frequent field observations, overlay of geologic, topographic and other maps, interpretation of aerial and satellite images and update of existing maps with current regional conditions, use of formal reports, related dissertations and statistical comparisons in order to analyze data such as landforms, vegetative cover or even local communities were other actions which were taken to find detailed potentials and future applications of geotourism. By involving segregated criteria and zones, geotouristic potentials classified and prioritized. Since geomorphologic extents and geologic structures and their distribution play a vital role in increasing potentials for geotourism in the area, this study suggests that due to dispersion of the sites and other concerned factors such as lack of tourism infrastructures scientific and educational geotourism are the first priority followed by adventurous, anthropologic and mining geotourism.

2. Definitions

2.1 Geotourism: geotourism is one of specific tourism branches dealing with introduction of geological phenomena the tourists while maintaining their spatial identity. Geotourism plays geomorphology, geotechnics, terrestrial geophysics, geochemistry and climatology. Protection of the environment and its landscapes and prevention of human interventions in upsetting the face of earth are main objectives of geotourism [15].

2.2 Geopark: is the abbreviation of geological park which is an area with a geological heritage of significance, with a coherent and strong management structure and where a sustainable economic development strategy is in place. In other words a geopark is an area containing one or more sites of scientific (not only geological but also archeological or cultural) importance [14].

2.3 Geodiversity: describes the rocks, sediments, soils, fossils, landforms, and the physical processes that underlie our environment. The first book to focus exclusively on the subject, Geodiversity describes the interrela-
relationships between geodiversity and biodiversity, the value of geodiversity to society, as well as current threats to its existence [13].

2.4 Geoconservation: identification and conservation of geological and geomorphologic phenomena, soils, processes and systems due to their aesthetic, ecologic and their place on the list of earth science heritage [11].

3. Geographical location and natural characteristics:

Dorfak and Deylaman No Hunting Zone as vast as 37899ha is situated in northern profile of Alborz Mountain Range on the northwestern slope at the foot of Dorfak (Dolfaq) Mount between 36° 51'37" - 37° 02'58" northern latitude to 49° 35'44" - 49° 58'30" western longitude 70km south of Rasht. The study area is a perfect sample of Alborz geology. Stratigraphically, Shemshak formation containing coal like argilite sandstone deposits and shale silstones is dominant. This formation is susceptible to landslides and earth quakes. Lar formation lying on the sides of Shemshak formation contains lime deposits pertaining to Upper Jurassic [5]. Dorfak Mount located at the east of Sefid Rud in the south of Rasht one of the highest elevation of Gilan Province which on the high end of Tithonian deposits of this area outcrops of volcanic rocks are seen between the strata probably indicating movements between Jurassic and Cretaceous. Beyond them, limestone and Neocomian deposits have been settled as thick as 800m. Upper sandstone and conglomerate part is believed to belong to Barmian. Apsian and Albian deposits are scattered in Dorfak Mount together with Orbitlinal fossil totally lying on the older deposits. Thickness of Mastrichian deposits made of sand limes on Cenoman deposit which sometimes reaches 2000m is of special significance. [3]. The area is classified to mountains, hills and rivers which mountains and hills cover %51 and %42.6 respectively [5].

4. Geology and geomorphology:

From the view point of geological zonation, the study area lies in Western Alborz Zone. Stratigraphically, Shemshak formation containing coal like argilite sandstone deposits and shale silstones is dominant. This formation is susceptible to landslides and earth quakes. Lar formation lying on the sides of Shemshak formation contains lime deposits pertaining to Upper Jurassic [5]. Dorfak Mount located at the east of Sefid Rud in the south of Rasht one of the highest elevation of Gilan Province which on the high end of Tithonian deposits of this area outcrops of volcanic rocks are seen between the strata probably indicating movements between Jurassic and Cretaceous. Beyond them, limestone and Neocomian deposits have been settled as thick as 800m. Upper sandstone and conglomerate part is believed to belong to Barmian. Apsian and Albian deposits are scattered in Dorfak Mount together with Orbitlinal fossil totally lying on the older deposits. Thickness of Mastrichian deposits made of sand limes on Cenoman deposit which sometimes reaches 2000m is of special significance. [3]. The area is classified to mountains, hills and rivers which mountains and hills cover %51 and %42.6 respectively [5].

4.1 Geological and geomorphologic units in the area:

- Mountains: Dorfak Mountain Range as one of the highest mountains of Alborz is in the form of an east to west huge mass verging on all the elevations (SiahRud basin) and has several peaks the highest of which is at the south. The highest peak is 2720m. Dorfak Mount is mostly consisted of different cretaceous limes. Water and dissolution erossions have had great effect and have created various forms of karst [9].

- Hillside: The extent of hillslides and lands with a gentle morphology are great with regard to mountainous area and rivers cutting the elevations. Western hillslides are covered by forests leading to lowlands of SefidRud valley. The slope is %30 in southern hillside %57 and %58 in northern hillslides, respectively. In the eastern side, there are elevated lands with a gentle slope used by country side populations [9].

- Hills and gentle slope hillslides: These closed and scattered enclosures with a topographical gentle slope (%15) occur in the range of volcanic rocks and Paleocene tuffs. A considerable amount of alluvium and loose sediments cover these rocky formations. [9]

- Valleys: All valleys in this unit are made of erosion and are maintained due to water currents on the previous flat surfaces. The longest valley that is the main waterway is SiahRud Valley [9].

- Crag: Dorfak fault causes severe downfall of northern hillslides compared to southern ones. Between two sides there is a regular crag verging on northern hillslides the highest part of which is the northern wall of Dorfak with the height of 800m and topographic slope of %80. Therefore, main reason for creation of these walls is Dorfak fault. Since, the walls have been created by the fault it is known as 'primary (original) crag'. [9]

- Dorfak Fault: This east-west fault is on the north of the study area and has created a great break in Jurassic limes. It is a thrust fault and its walls are steep 900m high. The slope is northward and approx. %80. Other faults are Rajeon, Chambal and Shirkand. [9]

4.2 Hillside processes in the area:

- Collapse: collapse is mostly as a result of expansion of volcanic basic rocks, acidic tuffs, andesites and Paleocene lichens. This occurs in Ab Sidan basin within Neocene territory. Slope movements are towards collapse of rocks, pebbles and fine stones on vertical walls made by erosion of Ab Sidan River. Volcanic rocks and paleogene tuffs are not strong and coherent in these areas and Rudbar Fault has resulted in many breaks.

- Landslides: many landslides have been observed in Dorfak in one or more phases ranging in scale from small to huge. The initiator of slides is tectonic forces intensified after the earth quake in 1990. Important slides include: Dorfak, Totakaban, Divdarre, Soosaf, Angoorchale, Barre Sar, Anar Kool, Agboz Chale, etc. [9]

4.3 Karst phenomena:

Karst landforms and other related forms such as caves are found throughout the world, are valuable and most of them are in protected areas. Some are in the list of international heritage. Karst systems are not limited to river basins. Karstic areas might be part of a river basin or more extensive than its apparent boundaries because karstic zones are often determined by underground borders different from surface borders. Karst landscapes play a significant role in geodiversity of the earth.
the term kars: indicates a unique landscape formed by dissolution of rocks by natural running water [7].

- Dorfak polje: At the south of Dorfak peak there is a vast closed pit sloping gently towards the center. Ridges have surrounded the pit. The only access is through a path within a valley in southern part. This polje has been formed in times of upper Jurassic including gray to light gray lime stones. The bowl is 2000m long and 700m wide.

- Doline: circular and small tub like cavities appearing on the calcic hillsides in light brown without visible vegetation. These cavities vary from few to tens of meters. The bottom of dolins is lined with clayey material resulted from clayey lime. This clay is produced by unsolved elements of lime stones [10].

- Lapje: abundant cuttings in form of cracks in rocks of karstic areas which may be exposed or be covered by soil (invisible lapje). They are formed as a result of dissolution of calcic stones in carbonic acid of rain water sometimes as deep as 1m [12].

- Dorfak (Toochal) Cavernor cave: caves in a variety of sizes and lengths are important phenomena in the study area which much effort has made to identify and record their coordinates using GPS. Dorfak Cave is the most famous one located at west of Dorfak polje. Its mouth is wide. From the mouth to bottom there is a gentle sloping ending to an underground river. The river is resulted from melt down of ice. The locals claim that before the earthquake in 1990 there used to be a way at the end of the cave that connected it to a big corridor at the lower part. This cave is the biggest natural glacier in Gilan covered by snow in all seasons. The bulk of the cave is made of calcic masses. There is another glacier in southern part of Dorfak polje looking like a well. Its slope is gentle on one side and steep on the other. It has also been formed in Upper Jurassic [9].

5. Conservation of caves and karstic areas:

Millions of people live in karstic areas. Some of these areas are unique among world landscapes but their quality has largely decreased or they are permanently degraded. Access to water is often a determining factor in settlement patterns and management of water resources in the long run (or even in some cases in short term) results in survival of the inhabitants. Mysterious and aesthetic character of karstic environments often attracts visitors to these areas particularly to caves.

5.1 The reasons for conservation of such sites are as follows

- A habitat for endangered plant and animal species
- Sites containing scarce minerals or special landforms
- Sites used for geologic, geomorphologic, paleontology
- Sites of, cultural, religious and historical or pre-historical importance
- Usage for industries or agriculture
- A window for understanding regional hydrology
- Source of minerals specially ground water
- Tourism incomes and other economic benefits
- Visual Recreation & etc. [7].

6. Other criteria for selection of Dorfak & Deylaman Geopark

- Arboreal species of the area are: beech, oak, maple, Persian Parrotia and alder. Most important rare and endangered species include: yew, ash tree, cherry and white lily (Lilium ledebourii)

- Among mammals brown bears and weasels are the biggest and smallest carnivors of Iran. Persian red deer (Maral), chamois are dispersed in the area. Lynx wolf, forest cat indicate health of the ecosystem. Otter and red spotted trout are indicators of high quality of water in four main rivers. Caspian snowcock is an important bird in Dorfak elevations and pheasant is found in western and northern parts.

- Ancient castles of Shirkhalaye and Sheikh Sara, Titi caravansary (monuments of Safavi dynasty), old cemeteries of Poshtehsara, Taleshsara, Sistan and caves of Espahdan, Kharbare, Noohchah and Kashkooh which are attributed to be settlements of primary humans are historical monuments of this area [5].
Conclusion and recommendation

In Iran with regard to its unique geography and diversity, more geoparks could be introduced to UNESCO GGN (Global Geopark Networks). At present, Qeshm Geopark is the only geopark in Iran. Development of geoparks in Iran is essential because of geologic and geomorphologic advancements in Gilan and the consensus on conservation of geologic heritage. This is important due to its relevance to vital issues such as environmental conservation, sustainable development and employment.

During last three decades, many studies have suggested that biological protection is essential for the each human being. Thus, loss of biodiversity has taken been into consideration in the international level [2]. Until recent decades, there was no international knowledge about sites of earth heritage and their importance [14]. Today, it is the time to conserve our natural heritage as well as our man heritage as the last destroy will lead to irreversible consequences. Geopreservation has found its place in programs of regional and national organizations. Further knowledge about geopreservation is much significant in scientific and formal levels. Since education and generalization of earth sciences is an aim of geoparks, Dorfak and Deylaman Geopark can develop geotourism and will play an effective role in raising awareness about geosciences and geopreservation due to having some of the most spectacular geological heritage, environmental potentials, morphologic landscapes and variations of forms in southern and southern hillsides, deep valleys, landslides and earthquakes, etc. for this purpose the following are recommended in order to raise the public awareness about geosciences and geopreservation:

- Site selection and introduction of zones having geological and geomorphologic potentials to be registered in list of earth heritage
- Register Dorfak and Deylaman in UNESCO
- Identify geosciences and environments of geological heritage along with cultural heritage as a sustainable development strategy
- Environmental protection (reduction of types of avoidable issues such as pollution and waste production, optimization of water consumption, optimal use of waters)
- Establish government management office and museum
- Consistent cultural measures of local communities, public and the government towards conservation of unique landscapes
- Prepare of films, brochures, books, CD-DVDs
- Screen programs for identification geotouristic phenomena in the province
- Governmental support from universities, private sector and interested graduates
- Conservation and management of fragile ecosystems especially caves and karst
- Prevent of degradation of geosciences phenomena due to lack of awareness
- Local participation of and promotional (promotion of villages by sending geology experts)
- Train authorized geotourism guides and related holding courses
- IRan monitoring plans on geosciences
- Rise the level of protection of Dorfak No Hunting Zone to a higher level (e.g. wildlife refuge)
- Take legal actions for combating smuggling and poaching
- Protect typical species like Persian m dore, chamois, brown bear, Caspian snowcock
- Issue no license for mining or quarrying
- Centralize the activities in areas of lower fragility

References


Guan Chenech: the Canary Islands and Guanche culture

By Maria Ilaria Pannaccone Apa1, Fabrizia Boongiorno2 and Sergio Barreiro Rodriguez2

The volcanic origin and activity of the Canary island territory represent one of inhabitants growing factors along the recent geology, besides, the rich land fertility due to lava flows, was one of the reasons of their colonization by guanche culture from prehistoric phases. Their social organization, based on chiefsdoms, aimed to preserve the canary volcanic landscapes. In this work, an ethno-historical approach and a resilience analysis to volcanic events of these guanche settlements, will discuss through archaeological information arising from the colonial sources (relatos) and Spanish corpus Lei. We hypothesize that local migratory fluxes were the consequence of resilience mechanisms generated inside and among islands, promoting the exchange between inter-islander ecosystems. The volcanic eruptions with low explosive features during last 10,000 years did not caused major cultural changes, whereas large ash falls produced a real damages with the consequence of human displacements along the limited island territories.

Introduction

During the last century, the archaeology of Canary performed the scientific study about Guanche traditions and a chronological sequence of the sites (cave, outdoor, burial) through important archaeological surveys, excavations, anthropological and domestic equipments (pottery, weapons, clothing, food) analysis.

Nevertheless, several questions are waiting, since now, for an answer.

The main problems we found during our research have been focused on recalibrated chronological of all the canary island settlements (life sites, burials, barnyards).

The canary context is generally very difficult to classify, mainly because of his physical environment and the constant landscape remodelling due to the continuous eruptions that followed over time.
1. TENERIFE

1.1 GEOGRAPHICAL AND GEOLOGICAL SETTINGS

1.1.1 Landscape and Climate

The relief of the islands is critical, climatic conditions enhance the variety and richness of its flora and fauna. It can be seen as Lanzarote and Fuerteventura are generally dry and arid, with heights of 671 m a.s.l. and 807 m a.s.l. unable to retain moisture of the trade winds that are responsible for the humid conditions of other islands, reaching its highest development in La Palma and Tenerife (2,423 m a.s.l. and 3717 m a.s.l.). There are two conditions that distinguish the canary landscape, as the high altitude bioclimatic layers and the difference between the northern wet and southern dry slopes. Moreover, the Azores anticyclone play a key role in dynamic meteorology located in the north Atlantic island, being responsible for the constant pressure of NE trade winds, with continued rise of moist air from the low layers stopped by an upper warm and dry layer facing the trade wind thermal inversion located between 950 and 1,200 m a.s.l., generating a sea of clouds; this condition offers a great climate stability for Tenerife island.

1.1.2 Volcanism of Tenerife

The island of Tenerife, which had constant volcanic activity since its genesis dated between 12 and 11 million years ago (Carracedo, 2006). This large triangular island is composed of a complex of overlapping Miocene-to-Quaternary stratovolcanoes that have remained active into historical time. The NE-trending Cordillera Dorsal volcanic massif joins the Las Cañadas volcano on the SW side of Tenerife with older volcanoes, creating the largest volcanic complex of the Canary Islands (Figure 2).

Controversy surrounds the formation of the dramatic 10 x 17 km Las Cañadas caldera, which is partially filled by 3715-m-high Teide stratovolcano, the highest peak in the Atlantic Ocean.

The origin of the caldera has been variably considered to be due to collapse following multiple major explosive eruptions or as a result of a massive landslide (in a manner similar to the earlier formation of the massive La Orotava and Guimar valleys), or a combination of the two processes (figure 3).

The most recent stage of activity beginning in the late Pleistocene included the construction of the Pico Viejo and Teide edifices (Figure 4).

Tenerife was perhaps observed in eruption by Christopher Columbus, and several flank vents on the Canary Island's most active volcano have been active during historical time. The spatial distribution of the islands corresponds to the ages of sequential growth and emergence of each beginning with Fuerteventura and Lanzarote emergency aged over more than 20 million years continuing to Gran Canaria (14-15 Ma), Tenerife (11-12 Ma), La Gomera (9-10 Ma) and La Palma and El Hierro (1-1.8 Ma) (Carracedo, http://www.volcano.si.edu/world/volcano.cfm?vnum=1803-03) (Figure 5).

The volcanic geology creates very fertile soil and permeable materials that allow water infiltration by running slowly getting his presence continuously. The chronology of volcanic events related to human presence on the island, have strongly affected the nature of housing strategies and the kind of adaptation to a changing environment, so dangerous as generous and reach on natural resources.

Figure 1. Canary Island and western African coastline, trade winds and Ocean streams.

Figure 2. Geological genesis of actual Tenerife island.

Figure 3. The origin of the caldera has been considered to be due to collapse following multiple major explosive eruptions or as a result of a massive landslide or a combination of the two processes (Carracedo, 2006).

Figure 4. Aster and Hyperion satellite images of Teide and Pico Viejo (elaboration of M. Musacchio, 2007: FP6-"Preview" Project).

Figure 5. Teide Volcano from La Esperanza region.
The human settlement chronology is almost discussed. Since now, the most ancient chronologies are given by Barranco de la Monja (Fuerteventura) (Figure 6, Figure 7), end late III – early II millennium B.C. (Onurbia et al. 1997) with some fragmented bones of sheep, and La Graziosa (Lanzarote): early I millennium B.C. (García-Talaver, 2003). Since now, the most ancient settlements of Tenerife island are dated around IX-VIII centuries B.C. (Gonzaléz, del Arco, 2007).

2.2. PATTERNS OF SETTLEMENTS AND SOIL USE

In the present work we have limited our attempt to apply theoretical models of resilience to the island of Tenerife, which highlights archaeological data inform us of intensive land use with both transhumant pastures and sporadic grown intensively in support of pastoralism, the main source of livelihood of the islanders.

The interaction and the exploitation of the Tenerife territory is made up of natural barriers that make his central part almost inaccessible, so that the current settlement pattern of the island overlaps that of protohistoric period.

2.3. SOCIAL ORGANIZATION

Social Guanche structure was organized in menceyatos, a chiefdom probably patrilocal-patrilocal based. Spanish chronicles (Torriani, de Viera y Clavijo, Nuñez de la Peña) in-
form that, Tenerife was divided into nine menceyatos: Adeje, Daute, Icod, Taro, Tegueste, Anaga, Abona and Güimar, each one independently ruled by his Mencey. It’s important to emphasize that political boundaries between menceyatos coincided with strong natural barriers (ravines, deep embankments, old lava flows difficult to overcome, etc.). Those menceyatos were subjected to an internal hierarchy, whose leader was the king of Adeje (Figure 11).

The whole political system of the island was ruled by councils of elders charged to practice high and low justice, to elect new Menceyes, having an important role in menceyatos wars mitigation. The fights between the kingdoms were basically generated by an unique and common land exploitation system in which the transversality of pastoralism, with related seasonal pastures, was overall dominant due to a restricted island territory to be exploited.

Sealing the informations resumed on the spanish sources (XVI-XVII A.D.), archaeological researches have confirmed both the presence of elder assemblies (Tagoror) and seasonal barnyards along Las Cañadas de Teide. In other words, the lack of differential land exploitation, such a market specialization exclusive for each menceyato without productions of almost selected goods to be exchanged with those of another menceyato, produced a non-interactive groupings in terms of trade. This lack of specialized goods production for inter-menceyatos exchanges, could be the explanation for territorial struggles, where an hypothetical group displacement was almost impracticable for the obvious geographical characteristics of Tenerife, an island far from the continents (Pannaccione Apa et al., 2008).

However, also a sporadic trade with the other islands was carried out by the Guanches of Tenerife, mainly with the neighbour Gran Canaria, very rich in biodiversity. In any case, they never performed a real specialized import-export within the archipelago.

2.4. SPATIAL SETTLEMENTS DISTRIBUTION AND LAND CLIMATIC EXPLOITATION

The settlement strategy of Tenerife island is almost due to geography and climate (Figure 12).

A analyzing the archaeological distribution map elaborated by L. D. Cuscoy (2008: 308), the following could be pointed out:

1. Humid zone: Generally, permanent sites (settlements and necropolis) lying along the island coastline, note a major concentration to N-NE, as the high humid climate was responsible of wide forests (laurisilva sp.), water sources (as natural repositories, basins, etc.) and easy access to the beaches, excluding menceyatos of Tegueste, Anaga and northern Güimar;

2. Dry zone: Mainly devoted to pastures. Practice of transhumance is confirmed by several seasonal barnyards along the Cañada del Teide and the southern Tenerife, following the menceyatos of southern Güimar, Abona, Adeje, Daute and Icod.

3. Coastline: During proto-historic period was less exploited. Several graffiti representing boats and ships, found at Tenerife and other islands, confirm that Canary archipelago was frequented by punic fishermans around IX-VIII century B.C., for the sea-

sonal tuna fishing; moreover, a roman period is attested with some sigillata africana potsherds, besides fragmentary parts of Dressel amphora (groups: 2-4; 7-11) discovered at La Graciosa (Lanzarote) and Tenerife, during a submarine archaeological survey (Lanzarote).

2.5. INTERPOLATION BETWEEN VOLCANIC EVENTS AND GUANACHE SETTLEMENTS

Following the great study on Tenerife volcanism

Number of eruptions is major in NW Rift than in the NE one. Comparing archaeological sites distribution of this region is evident that central Daute territory was quite impracticable, resulting by only sporadic caves settled (Figure 14).

In general, it might suppose that volcanic activities of Tenerife island didn’t have very strong and catastrophic consequences for the proto-historic inhabitants. This is appreciable in the lack of those topic symbolic markers found in other cultural contexts strongly related to volcanism (as Andean Riff, Hawaii, etc.).

Figure 11. Distribution map of Menceyatos in Tenerife island (elaboration from: Cuscoy, 2008: fig. 9).

Figure 12. Distribution map of Guanche proto-historic settlements in Tenerife island (elaboration from: Cuscoy, 2008: p. 133).

Figure 13. Chronological table of eruption events along the last 1,800 years. El Ciego eruption of 2790 BP can be correlated with the beginning of Guanche occupation of Tenerife (elaboration from: Carracedo, 2006: fig. 21, p. 79).

Figure 14. Volcanic eruptions and lava chronology of NW Rift. Tenerife island. Black circles indicate El Ciego volcano eruption, 2790 BP (elaboration from: Cuscoy, 2008: fig. 12).
2. Storms: The phenomenon of greater impact and a high frequency in the islands as the weather storms, is usually associated with storms that can generate high precipitation in hydrological risks of floods, high winds, landslides, mudslides, and landslides. Specific phenomena and, in same cases, winds carrying locust invasions, could cause severe famine in the population.

There are three types of behaviour that may take communities to high-risk events in the first place the ability to absorb the pressure through resistance or adaptation prior learned from the effects of hazardous agent, the ability to manage or maintain certain functions and the basic structure during contingency and then, not least, the ability to recover after the event.

Based on these processes can pose several assumptions about the principles of resilience of guanche communities:

1. Knowledge of the phenomena: it is difficult at the present moment about the Guanche结算tment pattern, mainly based on living-caves, preferring "paohoe" lava tubes as shelters, etc., with few evidences of outdoor architectural structures, was a well resilient strategy in case of earthquakes, but resulting a weak model in case of landslides, pyroclastic products, fires and all those concatenated effects derived by an eruption (Figure 16).

2. Transmission of knowledge: There are few symbols or spellings found and no writing. It's possible that resilience mechanisms were discussed during the Tagoror assemblies, but we haven't, since now, any precise information from archaeological evidences nor from Spanish chronicles analysis; it's also possible that the chronological distance between the eruptions wasn't so remarkable to symbolize the hazards into the oral transmission (as legends, stories and tales) as well graffiti and pictorials.

Moreover, the constant social instability between mainlanders producing high mortality of young adults men and women and the absence of an interactive internal trade, should be considered as a discontinuous curve of traditional transmissions between chiefsdoms in peace time, resulting fragmented both loss and acquisition of crucial informations regarding hazards, etc.

3. Conclusions

In general guanche social structure, based on chiefdom, the Meneyesatos, poor on technologies and strictly related to natural resources, could be considered as a real winning survival strategy face to an active volcanic island.

The locational analysis (Johnson, 1975) carried out in this brief report shows that the western meneeyesatos were almost populated despite the possible high risks resulting from eruptions, landslides and lava flows. On the contrary, it seems clear that there was a total adaptation to the landscape, given by the high proportion of occupations in cave.

Resilient mechanisms were probably transmitted during Tagoror assemblies, as a common strategy to face the events, despite the Spanish chronicles didn't inform of any particular guanche cultural tradition associated with Teide volcano and related hazards.

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The Influence of Volcanic Topography on Etruscan Culture

By Ann C Pizzorusso

Gases, vapors, radiation, thermal waters, magnetic anomalies and thermodynamic effects were all characteristics of the major Etruscan settlements in Etruria, now a part of Tuscany and Lazio. The volcanic activity in Etruria, west of the Apennines, began about 10 million years ago, leading to the formation of the largest expanse of volcanic topography in continental Europe. During this period there were distinct intervals of eruption and erosion which continued until about 50,000 years ago. The first phase of volcanic activity resulted in the creation of the northern volcanic hills of Tuscany, with Monte Amiata at their center. About a million years ago, another violent series of eruptions formed the crater lakes from Bolsena in the north to the Alban Hills south of Rome, to Vesuvius in Naples. The strength of the eruptions north of Rome was such that it forced the course of the Tiber River eastward to its current location. The geology of Lazio is very complex, with a vast number of differentiated systems continually overlapping each other. The most distinctive feature is, however, the presence of two ancient volcanic systems: to the northwest, the volcanoes Cimini and Sabatini, near Viterbo; and southeast of Rome, around the Alban Hills, the volcano Laziole. Lake Bracciano, a former flood basin, and Lake Albano, a crater lake, mark the center of these two geologic systems, of which the present day Lazio constitutes the approximate line of separation. In satellite images of Italy it is possible to see the small circular lakes which now fill the main craters of the volcanoes.

This complex geologic history has brought about a large diversification in the nature of the soils and rocks which can be found throughout the region. The volcanic deposits of the area consist of mud and ash which cooled to form tuff. Subsequent deposits of the last 50,000 years are alluvial in nature. Erosion has resulted in the exposure of marine limestone formed between 250-70 million years ago in the shallow waters of the Tethys Ocean which covered most of southern Europe.

For the Etruscans, this volcanic land provided them with the opportunity to live well and thrive economically. The volcanic soil produced agricultural products, wine and oil of exceptional quality. The tuff, deposited over a large aerial extent, was used for the construction of homes, temples, walls for defense, and tombs. It also served as an ideal material for constructing cuniculi (channels) which collected groundwater or rainwater for domestic use. The mineral deposits of Etruria were not only a source of raw material but served as a source of wealth and power when traded. Iron, lead, zinc, copper and associated metals of gold and silver were the result of volcanic activity and the subsequent metamorphism in the area.

The landscape of Etruria was mysterious and frightening yet fascinating to the Etruscans. The land, which consisted of lava solidified into strange forms, poorly consolidated tuff and ash which would allow gases, vapors and thermal waters to gush forth, was a source of amazement. And yet, the earthquakes and poisonous gases emitted from the earth were cause for fear and caution.

The Etruscans had a mystic sense and their religion was highly organized. Their chief priests (aruspici) were responsible for the welfare of the community and based their well being on a peaceful interconnection between heaven and earth. Living in such a geologically active place gave them the opportunity to use the geologic phenomena for religious rites as well as use natural catastrophes as a warning that the heavens were not pleased with their actions. The Etruscan priests were not only religious or mystic they were persons of extreme intelligence who had undertaken a long and laborious course of study in a type of university, among which that at Tarquinia had the highest standing. They not only studied sacred teachings, but were required to master astronomy, meteorology, zoology, ornithology, botany, geology and hydraulics. Apart from the significant practical use associated with volcanoes and their deposits, the Etruscans assigned important cultural and religious implications to their presence. In Etruscan mythology, Sethlans was the god of beneficial fire, including that of volcanoes. He was subsequently known as Vulcan by the Romans and was worshipped at an annual festival on August 23 known as the Vulcanalia. It was the view of the Etruscan aruspici that a temple of Vulcan should be located outside the city, and the Volcano in Rome, following the Etruscan practice, may originally have been on or outside the Roman city limits before being expanded to include the Capitoline Hill.

Volcanoes were considered sacred. Monte Amiata, the only volcano in Tuscany, was considered holy by the Etruscans. Monte Amiata is the second highest volcano in Italy after Mt. Etna. It lies in Southern Tuscany near the boundary with Lazio and Circa 20km north of...
Lake Bolsena, the second largest volcanic lake in the world after Lake Titicaca, was dedicated to the goddess of earth and water Umbra (later called Volumnia by the Romans). In the ancient world, lakes were especially sacred, the umbilical cord or center point which connected heaven and earth. In most of the ancient civilizations, the lake was an entrance to the underworld and a way to communicate with the underground body of Mother Earth. The same significance is found in Cuma at Lake Avernus, in Peru at Lake Titicaca, the sacred lake of the Incas, at the Lake of the Sybil on Monte Vettore and at the Lake Cotilia near Rieti.

Lake Bolsena is Italy’s largest lake formed in the crater of an extinct volcano. It is at the center of the Vulsini Volcanic District of the Roman Campanatic Region. The Vulsini Volcanic Complex is the northernmost of the volcanic districts in Lazio. The main structural element is the vast basin of Lake Bolsena which is interpreted as a volcano-tectonic depression that has formed during successive phases of subsidence.

It is 81 m. deep and has a surface area of 113.5 km. (43.8 sq. mi.). It was formed 370,000 years ago following the collapse of a caldera of the Vulci Volcanic Complex into a deep aquifer. The two islands in the southern part of the lake, Bisentina and Martana, were formed by underwater eruptions following the initial collapse of the caldera. Historic records indicate that eruptive activity of the Vulci volcano occurred as recently as 104 B.C., but geologic evidence exists only for eruptions until about 150,000 years ago.

The lake was the location where the sacred national confederation of the leaders of the twelve Etruscan regions was held. The division of the Etruscan territory into twelve regions followed antique rituals and traditions. Every year at Lake Bolsena, the twelve Lucumoni (sacred kings) would gather for a large religious festival that celebrated the sacred union between the Sky God, Veltha and the Earth Goddess, Umbra. A new larth, or head king, would be elected. He would lead the confederation for the next year and renew the ancient pacts and allegiance to the gods. Lake Bolsena’s island, Bisentina, a remnant of a volcanic cone, was the omphalos, or sacred navel of the entire area. Sacred wells, cunicoli, underground chapels and cippi (stelae), all relics of sacred rituals, were found underwater. The territory of the lake with the surrounding sacred woods was called Fanum Volumnae.

To arrive at Lake Bolsena, the faithful world travel along pilgrim pathways, which were dotted with sacred altars and wells designed to be used as a connection between earth and heaven. The temple of Turan, the Aphrodite of the Etruscans, in Faggio Civita on the crater of Lake Bolsena is reached by an Etruscan road carved into the rock. Not just any road, but an engineering and mystical masterpiece in that vapors of hot air were emitted from an underground geothermal source. The vent is a profound, tight fissure of seismic-volcanic origin and is 15 m. long. The road is direct and leads to a small grotto which also emitted hot vapors. The road then leads up to the temple, situated on a knoll. Near the temple, other hot vapors came from a circu lar well. The Etruscan priests, using their knowledge of geology located the temple over a fumarole. The relationship of the apsipici with the telluric or internal powers is confirmed by the presence of a large fault south of the temple. One can suppose that the temple with its seismic fault was the site of a cult of the earth, whose power augmented from the volcanic of the underground. This practice had its origins in Greece, where at Delphi, the oracle gave her predictions near a renowned opening in the ground that emitted steamy vapors exhaled by the mother of the earth, the goddess Demeter.

The Etruscans developed a well-defined system of sacred geography which was integrated into their daily lives. All ritual and religious observance was based on the division of celestial and terrestrial space and sacred and secular affairs had to be coordinated with it. They believed that heaven and earth were crossed by a north-south axis, caro, and an east-west axis, decumanus. The priests had to decipher signs coming from the gods depending on the position of the sign emanating from the sky. This was very important in order to provide for the well being of the community. The east was a favorable location, because there the deities most sympathetic to man, had chosen to dwell. The north east was the most auspicious and promised good fortune. In the south the gods of earth and nature ruled. In the west, the terrible and merciless gods of the underworld and of fate dwelled. The quarter between north and west was considered the most inauspicious. The Etruscans even evolved a system of town planning based on these religious concepts, which were likewise reflected in the elaborate ritual prescribed for the foundation of a new city. In Etruria the town laid out in accordance with the sacred rules was considered a minute portion of the cosmos, harmoniously integrated with an all-embracing order governed by the gods. The priest, after fixing the north-south and east-west lines by the sky, turned to the south and pronounced the words: «This is my front and this my back, this is my left and this is my right.» Then wearing his conical hat (which survives today in the form of the Bishop’s mitre) and holding his litus (the Bishop’s crook), he solemnly marked out the cross of the caro and the decumanus.

The Etruscan temples were also constructed according to the rules of sacred geography. They faced a certain direction to allow energy to flow between heaven and earth. The priest was a conduit between heaven, earth and the underworld. The location of the temples was not only ritualistic, but provided a real connection to the earth. The Etruscans believed that there were underground lines of universal energy “ceques” which ran from one sacred location to another (even long distances). This connected one sacred location to another. Since Etruria was so volcanically active, the priests encountered, among other things, areas of geothermal activity, magnetic anomalies and underground springs. All these things added to the legitimacy of the idea that there were underground lines of energy flowing through the earth.

The remains of several temples dating to the VI-III century B.C. were found in Falerii (Civita Castellana). One is the Temple of Uni (Giuone) (Latin, Juno), the goddess of love and marriage. The remains of the temple were discovered in a deep valley where two volcanic gorges cross. The structure is embedded between tall, tufaceous rocks. The temple was oriented toward the southeast according to the sacred geography prescriptions.

The perimeter walls, still visible, were built of tuff. In the walls is a carved channel which runs along the perimeter of the temple. Water would have been running in this channel to be used for religious rituals. In this manner, another element, water, would have been combined with the earth to create a sacred location. It is interesting to
The Temple of Uni with that of Turan. At Uni the waters bring sacredness to the temple, at Turan the underground springs provide the same effect.

The eruptions of volcanoes in Lazio which began about 900,000 years ago and ended in about 280,000 years ago played a major role in the formation of the soil. In a large part of Lazio (especially in the south) volcanoes were responsible for the local variant of tuff called cappellaccio. Often situated just below the humus, the cappellaccio stratum is impermeable to water. To drain stagnant waters, obtain cultivable land, and assure its irrigation, ancient inhabitants often undertook large-scale projects, leading to a proliferation of channels, called cuniculi, which long puzzled specialists. They have now been dated to the V-IV century B.C. and are attributed to the Etruscans. Cuniculi are found in that part of ancient Lazio characterized by tuff and pozzolana. These formations originated in the late Tertiary and Quaternary periods following the eruption of a volcanic complex which formed the present day Volsini, Cimini and Sabatini Mountains and, farther south beyond the Tiber River and the city of Rome, the Alban Hills.

Water still flows in a few of these channels. The cuniculi are rectangular tunnels from 1.7-2.0 m. high and 60-70 cm. wide. Communication between the cuniculus and the ground surface is provided by a series of narrow shafts spaced at a distance of 40-60 m. from one another.

The cuniculi, while probably not longer than 200-300 m. each, spread out in Lazio for hundreds and possibly thousands of kilometers. The cuniculi were excavated almost exclusively for the purpose of obtaining pure water that had been made suitable for drinking by the filtering action of the earth on rainwater. The tuff was ideally suited to this design as it was easy to excavate, did not collapse and was impermeable. Interestingly, in subsequent centuries, when a troubled history prevented the inhabitants from maintaining the channels, the spread of marshlands and malaria transformed these regions into unhealthy isolated areas, feared by all travelers until the beginning of this century. Once again, the Etruscans displayed an expert knowledge of geology and hydraulics. The aquivices were expert diviners who knew how to find subterranean water, bore wells, dig water channels, supply drinking water in the towns, and install irrigation and drainage systems in the fields. They also collaborated with other priests who specialized in constructing subterranean corridors and tunneling mountains. As a result, many types of excavations have been found, serving a myriad of purposes among which are: aqueducts, drainage, water collection, diversion works, sewers, outlets of lakes, passages, places of worship, animal shelters, quarries and tombs.

In Etruria, the deep gorges resulting from the erosion of the tuff by rivers made transportation and communication difficult. Yet there are many traces of ancient roads and paths, cut through the tuff, which hug the sides of the cliffs. With increased economic development and wealth, these trails were replaced with roadways capable of accommodating carts. Many of the tracks of these carts are still preserved in the roads which still criss-cross Etruria. In fact, Etruscan road building is impressive from an engineering and artistic point of view. Many roadways were dug deeply into the tuff and designed for stability and efficiency. While the tuff was easy to excavate, it was not that durable. Instead of importing harder rock slabs as surfacing material, the Etruscans, recut and leveled the road as it became worn. They were also master bridge builders. While the bridges themselves have not survived, remnants of the roads leading to them and their foundations can be found in many parts of Etruria.

In addition to the fresh water resources which were abundant, the Etruscans realized the healing power of the thermal waters which were found in the volcanic terrain. The ancient Via Cassia passes through the "Plain of the Baths", known as such for the thermal springs that have been famous since Etruscan time. At Sasso Pisano, (Castelnuovo di Val di Cecina) we find the only surviving example of Etruscan baths from the II century B.C. It is exceptional from an engineering and artistic point of view. The complex hydraulic system, designed to carry water from the nearby hot springs, is an extraordinary engineering accomplishment. Limestone channels conveyed the water to the pools used for bathing and to a great outdoor fountain. This thermal spa was built upon an existing structure dating from the III century B.C. There were remains of a quadrangular Doric portico consisting of large square blocks of local limestone, to which were added, in the II century B.C., two thermal installations with pools and service facilities covered by tiled roofs. These structures were flanked by numerous rooms for visitors and pilgrims. A seal with the Etruscan inscription spural huflunas ("of the city") appearing on numerous roofing tiles most likely indicates that the baths were public. Abandoned for almost a century after having been damaged by a seismic event in the second half of the I century B.C., the complex, partially rebuilt, remained in use by the Romans who used these hot springs, rich in salts, for the dyeing of cloth. The last sanctuary built by the Etruscan nation prior to final surrender to the Romans was consecrated to the waters of Populonia. Thus it was amid steam, sulfurous fumaroles and the earth's heat that the last of the Etruscans consecrated their land to their gods.

Geology was an important factor in tomb design as it dictated the form, location and decoration which could be used. Certainly the tombs had a design and form which was driven by the artistic style of the period, but the geology of the area actually dictated the final form of the tomb and led to the development of tomb architecture and decoration not possible in areas with different topography. In Etruria, the tuff was a rock easy to excavate yet strong and resistant to collapse. The tuff also provided a surface...
Volcanic activity provided the Etruscans with a ready supply of building materials. Tuff represents the predominant stone of the Lazio landscape from which the Etruscans excavated their necropoles. Pepperino, lapis albus, is a volcanic tuff which originated from the Cimino volcano near Viterbo and is also found in deposits south of Rome. Detrital material which was embedded in the tuff cause the spots on the surface of the stone resembling pepper corns. Being durable and fire resistant, it was also used for bridges and aqueducts. Pepperino and tuff were also used by the Etruscans for their sarcophagi. Another material, "petit stone", a limestone imbued with a strong odor of onions caused by the sulfur in the underlying ground water, was a favorite of the Etruscans for funerary sculpture and sarcophagi.

Pitigliano, Sorano and Sovana are beautiful old towns lying atop high tuff cliffs. They are surrounded by steep volcanic canyons and many ancient sacred pathways. For the Etruscans this was the area of the divinities of the "world below", Phersipinal and Aita, and so the area hosts special temples, tombs and altars. Beneath Pitigliano is an intricate labyrinth of cellars. Here, a series of rooms extend nine to twelve meters into the tuff. In the area around Sovana there are many elaborate tombs, and the most important cliff settlements in Italy, two hundred caves, found in the Rocca di Vitozza.

One of the most geologically fascinating cities is Orvieto, which was settled as Velzna by the Etruscans in the IX-VIII century B.C. It is situated on the flat summit of a large butte of volcanic tuff. The site of the city is among the most dramatic in Europe, rising above the almost-vertical faces of tuff cliffs that are completed by defensive walls built of the same stone. Settlers have always dug beneath the city for diverse reasons; to create temples to obscure divinities, to find water, to extract building material for houses and for tombs. The result of over 3,000 years of excavating is a honeycomb of about 1,200 caves, passages, quarries and wells. Today, the area is mainly privately owned and used mainly as wine cellars as the constant temperature of 12-13°C preserves wine perfectly. Orvieto is also home to Etruscan ruins and the remains of a wall that enclosed the city more than 2,000 years ago. At the foot of the butte is the Etruscan necropolis of the "Crucifix of Tuff" which dates from the VI century B.C. and counts a hundred or so chamber tombs laid along a rectangular street grid. Assuredly, the achievements and religion of the Etruscans cannot be divorced from their landscape. Their mineral and agricultural resources allowed them to become wealthy and powerful. Their water, both natural and thermal, afforded them a salutary lifestyle. From the first settlements, there had to be some attraction to Etruria. Why there? Could it be that they came from an area that was volcanically active? If we look at a map of Europe and Western Asia we can see a clear path of volcanoes from Turkey to Greece to Southern Italy and then up to Etruria. If we look at the landscape of Cappadocia in central Turkey, we can see striking similarities in the way the populace carved sanctuaries, tombs and living areas out of the volcanic tuff. In Greece, active volcanoes with fumaroles and hot springs were considered sacred. And so, it is possible that the Etruscans originated in the eastern Mediterranean and chose to settle in Italy because it resembled their homeland.
Their settlement could have been facilitated and their culture could have advanced rapidly because the topography was familiar to them.

Once settled, with thermal hot springs, fumaroles, gases, earthquakes, minerals, magnetic anomalies, fractures, faults and crater lakes, they must have felt that the earth was alive. And, since the Etruscans were a spiritual, mystical people who venerated earth and heaven, we should ask the question “did the geology of their land have an impact on their religion”? Most likely it did. This land, which gave them so much and which exhibited a wonderful vitality, certainly influenced their religious outlook. It would have been normal to give homage to a bountiful earth and repent when the earth was offended by their actions. And so, the land they chose was also the land that gave them their sacred viewpoint; a viewpoint that was adopted and adapted by subsequent religions. If we look at their terrain, if we look at the volcanic patrimony, we too, can understand their perspective, their religion, and their love for this land.

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Volcanic small islands in Japan: restauation, risk management, volcanic tourism

A Case about Miyakejima island, Japan

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Miyakejima is an island in the Izu group, southeast of Honshu, Japan, administered by the Tokyo Metropolitan government, and the island locates 180 km south of Tokyo. As of January 1, 2006, the population of the island is 2884. Like other islands in the Izu Island group, Miyakejima forms part of the Fuji-Hakone-Izu National Park. The island is a granitic composite cone in origin, and the main volcano, Mount Oyama, has erupted several times in recent history. A lava flow in 1940 killed 11 people, and other eruptions occurred in 1962 and 1983.

Eruption

Volcanic activity on Miyakejima started in June 2000. The volcano eventually erupted, spewing massive amounts of molten rock. In 26th June, earthquake activity was frequent and emergent information about eruption had released, and next day, subaerial eruption was confirmed far from the 1km western direction of the island. Once eruptive activity looks like settled down, on July 14, 2000, earthquakes began to increase near the top of Oyama, and Mount Oyama began another series of eruptions, and at last 8th July eruption occurred over there. Since then, eruption occurred repeatedly. 7ig eruptions occurred in 10th and 18th August.

Evacuation

The case issued evacuation of all the islanders are only two times, eruption of Izu-Oshima in 1986, and of Miyakejima in 2000. Received the outlook which announced by the eruption forecasting liaison conference on 31th August, Head of Miyake Village issued evacuation of all the islanders except the people who work for protection against disaster, on 26th September. Refugees are temporary received into Yoyogi National Olympic Commemorative Center, and until
4th September, all residents were completely evacuated. Tokyo Metropolitan Government offered public housing as temporary shelter and requested other local government to support them. As a result that many local governments offered the public housing, islander's place of refuge extended widespread from Hokkaido to Okinawa. People who engaged in fishing industry took refuge in Shimoda, which has moorings and locates top of the Izu-Peninsula, and is near to Miyakejima, with their fishing boat.

**Sufferings**

Volcanic activities—earthquakes, fall of volcanic ash, emission of sulfuric gas, and outbreak of the mud flow after the activities—of Mt. Oyama caused a great deal of damage all over the Miyakejima. Above all, mud flow sufferings are so serious. Because of accumulation of powdery volcanic ash, the soil became difficult to penetrate rain, and mud flow broke out every rain. Mud flow caught the huge stone, big tree, and so on, and caused sufferings like destruction of houses and road. It broke off the lifeline, and made the island’s living functions paralyzed.

**Risk Management**

Miyake Village put safety control measures—for example, fix the regulative zone, issue an advisory and warning, establish active standards for sulfuric gas into effect on the basis of local ordinance. And, the local government prepared compact de-sulfuric equipment for the inhabitants who have high risk for effect of sulfuric gas, and to this measure, subsidy for disaster-protective facilities and equipment had granted. Elimination of waste and emissions, and diminishment of negative impacts on the environment.

Under the situation that cannot necessarily assure inhabitant’s health for the emission of sulfuric gas, July 2004, Miyake Village decided the basic policy “Coexist with sulfuric gas”, and lifted the evacuation issue and permitted the inhabitants to return to the island. “Coexist with sulfuric gas”, the local regulation of Miyake Village, provides three basic line which each inhabitants recognize and receive the risk of sulfuric gas, and try independently to secure safety of themselves (Self-help), corporate and help mutually (Mutual-help), and the local authority take measures to secure inhabitant's safety (public help) for the purpose of reducing risk by obeying surely this security rule.

“Risk Communication Act” put into effect to spread knowledge about sulfuric gas for Islanders. “Risk Communication” defined the impact which people and ecosystem suffered by chemical materials and environmental pollution as “Risk”. “Risk Communication” is the basic idea which attempt to reduce and control the environmental risk by having conversation with inhabitants and government and unifying the people concerned, and it aims to follow appropriate risk control measures. “Risk Communication Act” were carried out at Tokyo during evacuation, and at Miyakejima too, when the temporary returning were carried out. In addition to this, until April 2004, “Risk Communication” were carried out 65 times, by utilizing the islander’s gathering at place of refuge, and 1568 islanders attended it. Miyake village has been carried out the training course to train 129 member of the village staff as a charge of “Risk Communication” from June 2003. To attract and awake attention, Miyake Village had issued and distributed safety guide map, and handbook of volcanic disaster measures.
Tourism after Restoration

Miyakejima settled on "Tourism promote plan" in March 2006, and tourism promotion materialized along this plan. Islanders began to recognize that it is a good for tourism that their Miyakejima is a volcano island. In Miyakejima, we can see the trend to utilize volcano, volcanic landscapes and its by-productions, as resource of tourism. Now, workshop like "Volcanic island art (making a volcanic ash print)" is held there, and tour to see the new volcanic landscapes making by the eruption in 2000, like "Experience volcanic island: nature guide walk" is held.

Now, swordfish fishing contest and motorcycle event are held continuously as a reconstruction supportive event. Motorcycle event "Challenge Miyake" started in 2007 by the proposal of the Governor of Tokyo, which modeled after the TT race held in the Crown dependency Mann island. After start of 2007, the event has been held every year, but it is not clear whether these events become priming to attract tourist or not, because of the problem of sulfuric gas.

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The myth of Mount Etna: between literature and cinematography

Mount Etna and its myth

The history of Mount Etna is marked by a number of great natural events. This extraordinary active volcano is characterized by a unique environment. Its beauty lies in its landscape, as well as on the magnificence of its eruptions. Mount Etna has more than a thousand years of culture. The mountain has a history of creation and also of destruction. Etna has a capricious nature. It has been willing to destroy the work of human generations by the power of earthquakes or under the flow of lava.

The volcano has erupted millions of cubic meters of magma, alternating periods of explosive and effusive activity, and this has transformed its morphology during the centuries. In particular new cones have been created on the southeastern side of its summit, and lots of casts have been incorporated in the "Bove Valley".

Etna represents an island within the island of Sicily. It shows a constantly different environment characterized by strong contrasts. In Mount Etna the soil called "sciare" with rich woods and crops, is mixed with the "casade" characterized by old villas surrounded by lush gardens.

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Mount Etna is a black flaming giant that encompasses our origins and mars our destiny. It is a theatre of the myth and the art. The volcano is a holy place where strong perceptions, difficult to describe, are expressed. Etna is defined by Pindar (470 BC) as "the pillar of heaven" referring to its grandeur. It is primarily a mythical and mysterious place. It belongs more to the mind and the soul than to the body. The spectacular mountain we can admire today is a creation that summarises the work done, over millennia, by writers, painters, landscape engravers, travellers and more recently by filmmakers and tourists in search of strong emotions. There are numerous legends that describe Etna like the symbol of the supernatural and the home of mythical creatures, gigantic monsters, nymphs, demons, witches, fairies and heroes (Agati, 1987).

Historically, the perception of this natural beauty has both fascinated and terrified. While Homer enhances the fertility of its soil, "Here are raised skyward and the extensive forest growing rosy pomegranate and the apple and the pear tree and the tree of Pallas powerful" it does not harm the northern hemisphere winter or summer hot, but, as the placid zephyr blowing breezes,
year round, a beautiful fruit, and apples on the pommele sweet age than before. greenhouses new cluster appears next to the already sweet" (Bembo, 1981). Virgil describes emblazoned Etna while eruping "but with fearsome rains sware the whole requires now the smoke and pitch, balls of flame and sparks rising almost touching the stars, and sometimes the boulders, uprooted from the boulders of the mountains, erupting scale, turns in the debate while lightning is added with a roar of thunder, shaking all the deepest abyss... all Trinacria clattering shaves of hot clouds and the sky is covered" (Vigilio, Eneide, Book III).

The rich iconography is often imaginative, but also systematic and detailed. It is the result of the stories and descriptions collected by many travellers, often foreigners, who ventured the steep paths leading to the crater. Their difficulties, anxieties, and wonder, are described in number of travel accounts. Several Etnaean places were created made known through the enclosures enclosed.

In the eighteenth century, Antonio Mongitore wrote that Etna "made pens, poets minds, historians and philosophers tired." Spallanzani, Dolomieu, Houel, Goethe, Saint-Non and Brydon are only a few of many who have described the landscape, resting places (the hundred horses chestnut, the goats cave, the doves cave...) the means of transport, the local guides. These artists/writers have recorded both events and places we can only find in enquirer's work. The oldest famous mountainer was, according to the Augustan History, the Emperor Hadrian. In 125 AD, he visited the crater "in order to admire the birth of the sun characterized by such variety of colour, that it looks like a rainbow." However Strabone used records of explorers (the "Abantanes") in order to paint the "Geography of Etna.

In the nineteenth century we can remember Peter Bembo among the ancient writers who described his ascent to the crater in "De Aetna". In the following century the historian Toniachino Piscicarelli impressed by the volcano and he wrote "why doesn't it let the fire be extinguished by the snow or the snow be dissolved by the fire?".

Favaro Amadei (1591) begins in the volume Aetna Topographia writing "It's really a horrible vision that such a wonder the one which gives the Etna with snow and red of fire that is felt by the earthquakes that shake the whole island". This work is admirable considering its scientific approach in an attempt to eliminate the supernatural interpretation of the volcano.

Numerous travellers' diaries report the explorers discouraged in their effort to climb the crater. Most of them didn't give up describing with admiration the volcano. The Englishman George Sadler in the first decade of the sixteenth century, as well as the Dominican monk Jean Baptiste Labat (1711) were mystified by "the apocalyptic fire and flames escaping from the crater". The Prussian Baron Johann Herman Riedesel (1767) went up to the crater, and wrote "I was so astonished when I saw myself on the edge of this immense chasm, that I found it so big to be able to turn around the mouth. I threw some stones in this pit, but not the slightest sound reached the ears". The Scottish man Patrick Brydone (1790) observing the scene inside the crater, wrote: "rivers of fire erupt and throws out hot stones with a roar that shakes the whole island". The Danish Friedrich Munter (1776) wrote that "after having satisfied his eye and soul with an unforgettable view, as it could not be seen elsewhere in the world" he was forced "to leave the beautiful mountain... because the sun was close to sunset". In 1879 Goethe was more cautious. He stopped his visit in the small side craters called "Monti Rossi" the red mountains. He wished to see the summit of Etna "snow-covered and slightly forested". The "known traveller" Johann Gottfried Seume didn't give up going to the crater and therefore he reached it. In 1801 he reported his feelings in a very famous book. He arrived first "on the extreme edge of the immense chasm within the crater". He did not resist to the temptation of throwing a rock into the abyss, arousing the concern of the guides, who suggested him "not to wake the devils who are at the bottom of the cave" (Salmeri, 1997).

Since the nineteenth century there has been a fearless perception of this mountain. During the same period there was greater attention to the ethnic territory in its complexity. In 1827, Toucouleurs in his impression of the mountain, described "We George Santerno in a few minutes, then we are left without the possibility to go on in the middle of an enchanted landscape that will surprise you everywhere, but even more in Sicily. It is but a succession of orchards intermingled with huts and pretty villages, there is no wasted space, everywhere an air of prosperity and abundance".

The attention of the novelists of the nineteenth century focused mainly on the description of the landscape and on the emotions that arose in those who lived in these places. Edmundo De Amicis described, recounting the path with the railway Circumetnea and the 38 villages, "an earthly land, broken here and there by areas of hot". Giovanni Verga, used the special atmosphere of Mount Etna in his novel "Storia di una Capinera". "Tuzet wrote in 1995 that Etna is neither classical nor romantic: it is contemporary in the world: whoever has a sense of mystery—whether a Greek, Latin, Christian, "philosopher"—will be subjugated by the Etna". The volcanologist Haroun Tazieff mystified Etna by saying that "It seems that Etna has been in continuous activity for millennia". Among the writers who described Etna in the second half of the 1900s, Vitteliano Drizcasi and Ercole Patti must be mentioned. Leonardo Sciascia after having experienced an eruption wrote that "with less fear people who do not live in that area", can imagine a viewing of the volcano so faithful to be compared to a "huge pet, a cat that quietly sleeps and occasionally wakes up, yawns, stretches slowly and lazily, with a careless paw, now covers a valley, now another one deleting villages, vineyards and gardens" (Sciascia, in Bembo, 1981).

Even the cinematography has shown the magnificent scenary of this active volcano. Etna has several meanings, features and directors have been able to turn it to the needs of the narrative film. Mount Etna has been given place to create a fable or an adventure. It was contemporary or historical. Several film directors, including Zeffirelli, Visconti, Pasolini and Epstein, have grasped the deep mysteries and the most recollected suggestions of the myth. (Gessi, 1997).

The Etna landscape inspires the cinematographic production. The landscape is the most essential element in the history of the Italian cinematography. Theoretically, each film takes its natural humus from the landscape. The movie should be planned as an experience and not as an independent object. The plot can be developed looking at the relationship between the characters and the place, as well as the link between the various parts interested in the production. The elements of the second relationship are on one hand the character on the other hand the camera. Moreover, behind them, there is another point of view, which is the spectator. The landscape, presented in the film, is often a huge place where the characters try laboriously not to get lost.

The study of such extensive spaces has allowed the birth and the spread, during the XIX century, of the Italian realistic cinema. The landscape has been given place to create a fable or an adventure. It was contemporary or historical. Several film directors, including Zeffirelli, Visconti, Pasolini and Epstein, have grasped the deep mysteries and the most recollected suggestions of the myth. (Gessi, 1997).

During this period even experts in geography began to study the landscape through the cinematography. In the early nineties, a careful examination was performed by geographers on the story of some Italian films. They noticed that a degradation of the environment and the landscape had occurred, caused by a hectic and chaotic urbanization. These films recorded the social life and the crisis that took place in specific Etnaean areas (Landfranco, 2002). For those experts who believed that the film is an open museum, the Sicilian landscape was a myth. The vast natural backgrounds were amazing, in particular the coast of Catania characterized by the high cliffs, or the coast of Messina, with both small and large urban settlements. Sicily was a famous movie set thanks to its fantastic heritage melting myths and legends.

The cinematography has described and preserved the unique geographical scenery of the Mount Etna and of the city of Catania. The city of Catania is a natural set for films thanks to the streets, the squares, the sea and Etna. The filmmakers express, through their films, the significance of living under the tallest European active volcano. The landscapes facilitate the cinema to place the stories and the human events happened in Sicily. The environment is an active element of the action. The Etnaean landscape, with its lava flows, eruptions, forests, chestnut was an actor.

The cinema had spoken about Etna and its extraordinary natural setting, modifying it according to the various plots. The images filmed in the territory of Etna highlighted the scenic importance of Etna as a natural resource of irresistible attraction. The cinematography has increased consciousness among the public in appreciating the foothill area around Catania. The movie art in Sicily and in particular in the area of Catania, has valued the foothill land both from a naturalistic and historic point of view. This art, combined with Sicilian cultural heritage has allowed today the creation of film tourist itineraries in the etnaean province.
Films made Etna

The environment, the place, the set have always represented one of the essential ingredients for a successful film. Great artists have made the environment one of the cornerstones of their style (La Magna, 2002). The success of a movie lies on the genius of its directors, the charm of the actors but also of the place where it was filmed. In many films, the places are actors themselves. The Landscape is something that pre-exists and survives after and aside the film. The cinema has used Etna as a location, changing its extraordinary natural beauty according to the film plot. The set of film and TV pictures, filmed in the territory of Etna highlights the importance of Etna as a natural and landscape element of irresistible attraction. The filmography has allowed an elevation of consciousness among the public viewers in appreciating the foothill area, with a new perception. Catania, and its province, have been selected by many Italian and foreign filmmakers. Catania developed many innovations that interested and improved the city. In particular, in 1890 the opening of the Massimo Bellini Theatre has inspired a lot of writers including De Felice, Martoglio, Verga, Capuana, De Roberto and Rapisardi. The precursor of the cinema used Etna to film the spectacular scenery of the etnean landscape, its steaming plume, its eruptions and its snowy peaks. These great natural events fascinated and intrigued the audience that crowded the cinema since then. The art of silence was around the landscape, the railway stations, the ports, the urban traffic, the walking along the beach, the snowy peaks of the volcanos (Gesù, 2005, p. 15). From 1909 to 1913, many filmmakers began to show a particular interest in the activities of the largest volcano in Europe. Between 1914 and 1916, "the Etna Film" was founded the first film of the most important national film production houses and the only one which had the largest soundstage in Europe. "The buildings is located in the outskirts of the city, between the green of the countryside and the black of the lava, in the district of Cibali, in Cybele street, and they were connected to the centre through a modern and fast tramway" (Genovese e Gesù, 1995, p. 36). The first shots made on the crater of Etna were made by the operator Maggiorino Zoppis. He was an experienced operator of the Etna Film, and he was sent to film in "The eruption of Etna" spectacular volcanic eruptions to be spread throughout the world, while the first films produced by the film company were: "The dance of the devil", "Appointment" and "The Sphins of the Ionian Sea". In the early twentieth century, the pioneers of the silent film in Sicily were the theatre company made up of the Catanean actors Giovanni Grasso, from Virginia Balistreri, Giacinto Pezzana and Toló Majorana. Writers such as Giovanni Verga and Nino Martoglio, who made a number of medium and short shots. In 1910 the "Cavalleria Rusticana" was directed by Hugh. This work brought Sicily to the forefront of the cinematic representation. In 1913, Nino Martoglio directed "The leap in the dark", a silent film set at the Etna slopes in the resort of Torre del Grifo. In the 1930s, the theatre group of Angelo Musco gave birth to the first feature films filmed in Sicily. He allowed the sharp transition from the dialect theatre to the Sicilian cinema. "The earth trembles" by Visconti, deserves a special attention the neo-realist film after the war. This film recreates a superb interpretation of the novel, "M'Alvovigla written by Verga. Visconti speaks about the Sicily named by Verga "allegorization". The film director, presented in 1948 a great masterpiece of the Italian cinematography located entirely in Aciretza and Acicastello. Another work of Verga that became a film was the novel, "The story of a chickadee" was directed by Joseph Stern in 1917. The second interpretation was made in 1945, by Gennaro Ruler in Bronte. The film was interpreted by cast Martina Berit and Claudio Gora. The issue which was best known by the public, was "Story of a blackcap", brought to the big screen by the director Franco Zeffirelli. "La Lupa" filmed in the 1950s by the director Alberto Lattuada is another famous work of Verga. The director did not use the background landscape of Sicily to tell the passion between the two characters, but he transported that tragic and passionate Sicilian atmosphere in Matera. However, this city was unable to give the same atmosphere required by Verga. The writer Pierpaolo Pasolini was the first who described the natural richness and the myths of Etna. The volcano has a lunar and mysterious landscape of an extreme scenic beauty. In the landscape presented by Pasolini, some of his films, the most famous of his prestigious career. Etna will become Pasolini favourite place, is allows which allowing his characters could move in an harmonious and natural way. In 1964 Pasolini filmed "The Gospel according to Matthew", on the slopes of Etna, recreating the story of the temptations of Christ in the desert. The second film filmed in the Mount Etna was "Theorem", which tells the story of the bourgeois man who loves consumerism. In the sixties, Sicily was invaded by extremely famous film productions, including biblical masterpieces. The "Etna becomes the privileged place which draws stories from the Old and New Testament", among which we include: "Sodom and Gomorrah", “Barabbas” and “The Bible” (Gesiù, 2005, pp. 45-55). Recently Etna is again the place for spectacular shots of extraordinary international cult films. In 2002 and in 2005 the director of "Star Wars", George Lucas, chose the eruption of Mount Etna as the background of some episodes II and III. Another characteristic village at the slopes of Etna, called Linguaglossa, was the setting of the film directed by Maurizio Ponzi on "I wanted Chicken pants" and inspired by the best seller written by Lara Cardella. This movie portrayed a retrograde and sensual Sicily, where the woman is always the victim of the so-called sadism patriarchal. The natural majestic of the Mount Etna has been used as set by many other films. Among those films is worth to mention "Here comes the storm" because this had the backdrop of both Etna and Noto. Later on, the "Capercaillie" directed by Carlo Verde, "Women of the Moon", by Vito Zagarrio, "Ginostra ", a thriller of Prada used the beautiful scenery own to this volcano. Those great directors have made unforgettable moments of their films in Mount Etna and these images are among the most beautiful pages of Italian cinematography. It must be stressed that the relationship between Etna and the cinematography is stronger since more productions have been made in a number of Etna villages. The film industry in Sicily has enhanced and promoted the territory seeking to improve regional economy. Therefore, the economy and the employment rate of local resources is noticeably increased. Recently, the Film Commission of the City of Catania, has been created in order to provide assistance to all productions recorded in the area and the landscape. The film Commission should have been crucial especially for obtaining local licences and for organizing press conferences. Unfortunately, the number of events, presentations, film premieres and festivals has been poor since the constitution of this Commission. In theory, a system to support the production should be used to build the culture of innovation. This will enable us to broaden our horizons. Starting from the cultural heritage, the tourism and especially the cultural tourism can become an area of development and an engine to enhance our economy. To give a definitive "I wanted Chicken pants" today is not easy for a number of reasons. It is difficult to determine the nature of this practice and, consequently, its field of study. The ways in which the relationship between subject and object and visitor and sites visited has evolved over the centuries has been established in cultural tourism studies. The revalorization of the cultural offer in tourism is mainly due to a progressive aging of the visitor's population. More in general, tourists can be harassed by the effects of globalization, and they want to reclaim their identity by adapting against the growing approval. For this reason we see a growing emphasis in the new visitor badge based on the element of an area that will determine his final choices. Tourists become actors in the territory through the interaction between enjoyment and experience. This can generate value. The tourism market should be managed in innovative ways. The new movie tourism approach will gather and interpret hidden needs. Requirements are often expressed in specific questions not yet materialized in the new tourist engagement. These stimulated by images conveyed in non-tourist couple in an induced his interest in the location depicted. A film represents a journey in which the tourist is stimulated by the vision of events, the places and the landscape. There is an imaginary where you relate the emotion and
Conserving the Cavate Pueblos in the Volcanic Landscape of Bandelier National Monument

By Angelyn Bass Rivera and Lauren Meyer

Summary

Amid the canyons and mesas of the Jemez Mountains in Northern New Mexico (US) is an ancient cultural landscape marked by thousands of tuff caves carved into the tuff cliffs. These troglodytic structures, known as cavates, were once part of large, complex settlements that were inhabited from the 12th to 16th centuries by the ancestors of modern Native American (Pueblo) people that still live in the area. The cavates, which were used as dwellings, storage, and special-purpose rooms, are part of a volcanic landscape of extraordinary natural beauty and cultural significance.

Despite constant and often extreme physical alteration of the friable tuff, many of the cavates are well preserved. A multi-phase project is underway at Bandelier National Monument to document, prioritize, and conserve the cavates as both constructed and natural heritage. This paper presents recent research and conservation treatments that respond to continuous physical landscape-level changes as well as indigenous views that embrace the natural processes of decay and renewal at these sites. Discussion focuses on how recent research and fieldwork has increased protection of the natural and cultural landscape and enhanced visitor understanding and experience of it.

Keywords: tuff, cave, Pueblo, cultural landscape, natural heritage, conservation, troglodytic, Bandelier National Monument, laser scanning (LIDAR), Bandelier Tuff, ecological restoration

On the eastern flank of the Jemez Mountains in Northern New Mexico is the Jemez Plateau, an area of high mesas and steep-walled canyons formed from erosion of the deep ash-flow tuff. The plateau was created by deposition of ash and other pyroclastic material from two separate caldera-forming eruptions that occurred approximately 1.6 to 1.2 Ma and 1.2 Ma to 40 ka. Bandelier National Monument, located in the southern portion of the plateau, is a volcanic landscape filled with Native American dwellings built of tuff masonry, including troglodytic sites carved into the cliffs. Ancestral Pueblo people and others have used the plateau for thousands of years with peaks in population occurring from the 1100s through the mid-1500s. Among the most extraordinary of the archaeological sites are the rock-cut chambers called cavates (derived from the words “cave” and “excavate”), which were used as dwellings and for storage and special purposes.

Also abundant are many built and natural landscape features such as multi-story masonry community houses, foot trails worn in the tuff, water collection and agricultural systems (Gauthier and Herhahn, 2005), stone shrines, and painted and incised symbols on the cliff faces and plastered walls. In 2000, the Vanishing Treasures Program initiated the Frijoles Canyon Cavate Pueblo Conservation Project at Bandelier, a multidisciplinary, multi-phase project to study and preserve the cliff dwellings and develop a conservation plan for their long-term protection.

Conservation of Cavates in the Volcanic Landscape of Bandelier National Monument

By Enrico Nicoia

The paper is the result of common reflections. Caterina Cirelli has written sections 2 and 3. Language editing was done by Enrico Nicoia.

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Frijoles Canyon, which contains over 1,000 cavates, two large freestanding masonry pueblos, several smaller masonry community and field houses, and a perennial stream, was, in prehistoric times, the most densely populated canyon in the area. Today, it is a popular destination among travelers, receiving over 300,000 visitors annually, most of them coming to see the cavates and other archaeological sites.

The principal goals of the Frijoles Canyon Cavate Pueblo Conservation Project are to develop appropriate methods to identify, document, conserve, and maintain the cavates as both constructed and natural heritage, and, through Native American consultation and planning, develop and implement a culturally adaptive management strategy for their protection and use (Matero, 2004).

The project has been implemented in three phases. Phase I involved archival research, development of the data collection methodology and procedures, as well as preliminary analysis of the earthen plasters and the Bandelier Tuff. In Phase II, the architecture and the physical condition of over 1,000 cavates in Frijoles Canyon were systematically recorded and assessed; a database and Geographic Information System were developed to integrate spatial data with detailed condition assessment information and images; a prioritized treatment schedule that divides the cavates into categories of high, medium, or low priority for treatment was prepared; a conservation plan was drafted that recommends both immediate and long-term treatments and monitoring activities for each cavate (Bass-Rivera and Meyer, 2006); and, pilot conservation treatments were designed and field-tested. In Frijoles Canyon, approximately 84 (8%) of the cavates are considered a high priority due to their archaeological/cultural significance and moderate to poor condition; 294 (28%) have a medium priority, and, 677 (64%) a low priority. Also in this phase, education and training in archaeological site conservation was provided to graduate and Pueblo students, conservation interns, archaeologists, and park staff.

Phase III is currently underway and focuses on scientific analyses and conservation of the high priority cavates. This includes detailed documentation (photography, laser scanning and mapping), environmental and structural monitoring, petrographic analysis and accelerated weathering testing of the tuff, and conservation treatment, primarily tuff infilling and graffiti mitigation.

Cavate Construction and Use

Cavates are unique in the Pueblo architecture of the Southwest United States. Not only are they carved directly into the tuff, but there are an extraordinarily large number of cavates, over 2,000 within the boundaries of the park and many more on adjacent federal and Pueblo lands. Due to their semi-protected location in the cliffs, many cavates are in excellent condition and contain architectural finishes and features that are rarely preserved in standing masonry pueblos from the same time period. Some extremely significant features, such as metate rests for processing grain and loom anchors for weaving, are only found in cavates. Modern pueblo people visit the cavates and acknowledge them as an integral part of the ancient landscape to which they are strongly and deeply connected. The Tewa description for the cavates is t’óvá tewha, which roughly translates to “old or crumbling villages against the wall” (Bass-Rivera, 2005).

Most of the cavates were carved into the soft, rhyolitic tuff, primarily into a weakly cemented zone where the two ash flows meet. They tend to be clustered on south or southeast facing cliffs that receive direct sunlight in the cold plateau winters. With this exposure, ambient temperature and relative humidity levels fluctuate radically, both annually and diurnally. These environmental fluctuations accelerate tuff erosion and weathering, which makes the cliff bases ideal for building and occupation, but problematic for preservation because of their progressive deterioration. Today the cavates appear as groups of chambers in the lower cliff faces, but when they were in use, most were the concealed back rooms of larger cliff-side villages constructed of masonry. Most of the masonry structures have collapsed.

Cavates were made by exploiting holes and fractures in the tuff and hollowing the rock with a stone scraper or wooden tool. After carving the chamber, the builders likely heated the interior with a fire. Heat hardens the granitic tuff (Riggs, et al., 2009) and the sooty residue from the fire coats the rock surface, protecting it from rapid disintegrating and providing a homogenous interior color and texture. The exceptional preservation of some cavates is due in part to this sooty layer. Cavate floors and walls were then finished with earthen plaster. Floors are usually many layers thick and form a hard, smooth surface on which to work at mealings bins, hearths, and looms. The interior walls have a dado, or band of plaster, approximately one meter high that terminates at eye level if one is sitting on the floor. Dados vary in color from red to white to yellow and can have up to 30 layers.
Some cavates also had mural paintings, but after centuries of aging and weathering, few are discernable. Conservation of the epaerreal earthen finishes and masonry enclosures is one of the park’s highest priorities.

Condition Assessment, Rock Analysis and Preliminary Treatment Testing

A challenge of conserving the cavates is how to do so in the face of constant landscape-level change and erosion of the cliffs. The cavates are slowly deteriorating from both environmental and human impacts. Preliminary geomorphic assessment of cavates and cliff bases in Frijoles Canyon has revealed that deterioration of the tuff occurs primarily through small-scale spalling and granular erosion, and to a lesser extent from large-scale rock falls. The primary processes contributing to gradual erosion of cavates are the discharge of water from the vadose zone at the cliff base, capillary rise of moisture into the tuff, and surface water flow down the cliff face, which often streams directly into the cavates through the entrances, smoke holes and vents.

Moisture infiltration combined with other complex chemical and physical deterioration processes such as soluble salts dissolution and crystallization, wet/dry and freeze/thaw cycling, and wind-blown particle abrasion, accelerate tuff disintegration and loss. These findings correlate with condition assessment data revealing that cavates on the ground level and in contact with the talus slope are generally more eroded and in poorer condition than those higher in the cliff. Among the more severe deterioration conditions are erosion and undercutting of the ceilings (preferential erosion), which often results in collapse, and disintegration and loss of the masonry entrances and earthen wall/floor plasters. In 2002, Bandelier National Monument and the University of New Mexico initiated field-testing both preventive and corrective conservation treatments in the high priority cavates. Treatments have been designed specifically for each cavate based on their tangible and intangible values (e.g. type and distribution of features, material integrity, spatial context etc.) as well as their physical condition. Our conservation approach emphasizes limited intervention, detailed documentation, and in some cases no treatment because of physical limitations or cultural preference.

This strikes a balance between preserving the form and fabric of some cavates while allowing the natural processes of decay and renewal for others.

As of 2008, approximately 30 cavates in Frijoles Canyon have been conserved. Treatments, which are generally imperceptible to visitors and are reversible or retroactive, fall into three major categories: (1) structural repair and monitoring; (2) conservation of the architectural finishes (plastered and sooted walls and floors); and (3) preventive maintenance, which focuses on causes of deterioration. Applied treatments include masonry stabilization, primarily repositioning with earthen mortars; plaster conservation by grouting voids, edging fragments, and retouching delaminated plaster layers; reducing tuff erosion rates, undercutting through stone consolidation and infilling losses with lime-based mortars; and graffiti mitigation by infilling and inpainting. Preventive maintenance also includes backfilling floors, covering social trails, and diverting surface water runoff with silicone drip lines, berms, and soil grading.

We are also testing various methods of documentation and non-destructive evaluation to record and monitor physical changes in the cavates and their landscape. In addition to photography, measured drawings, and total station mapping, laser scanning has recently been used (Holmlund, et al., 2005). Laser scanning, particularly the use of multiple types of laser scanners with a range of measurement characteristics, allows the creation of high-resolution 3D digital models that, when combined with photography, provide complete and accurate baseline documentation virtually impossible to achieve with other mapping techniques. When these models are referenced to highly stable and accurately positioned datums, they can be used to study and quantify the types and rates of architectural and rock deterioration, as well as for educational and interpretive purposes. Since these 3D models are completely metric, measurements, descriptions, and characterizations can be made directly from the models, and both researchers and visitors can study aspects of the cavates without climbing into them. Limiting access to the cavates not only reduces incidental damage that can occur during visitation, but is preferred by some Native American groups.

Currently Bandelier National Monument is working with the University of New Mexico, MIT and Western Mapping to laser scan and model a cavate in Frijoles Canyon that has one of the few surviving masonry enclosure walls left in situ.

The laser scan data will be used to record the wall geometry and produce a highly accurate TIN (triangulated irregular network) model. This TIN will form the basis of a structural model that will be used to evaluate potential impacts of continued material deterioration and establish thresholds of stability/failure. The high resolution model, created with custom software designed to incorporate variability in the masonry structures, may allow very specific predictions of wall behavior based on small changes in existing conditions. Adaptation of the model for monitoring of this and other sites, as well as additional photogrammetric analyses and weathering studies will be undertaken in subsequent phases of work.

Other Conservation Projects at Bandelier National Monument

Conservation of the volcanic landscape at Bandelier has been a priority since the park was established in 1916. For nearly two decades the U.S. Geological Survey and the National Park Service have been conducting long-term ecological monitoring at Bandelier National Monument focusing on vegetation growth, fire ecology, watershed management and erosion dynamics in pinyon-juniper woodlands. In 1996 these partners initiated an ecological restoration project to conserve Bandelier’s soils and biological productivity. This project also became extremely relevant to cultural resources and the protection of archaeological sites region-wide. There are over 3,000 ancestral dwellings and other archaeological and historic sites within the boundaries of the park; 99 percent of these are at least partially buried under a mantle of soil, which in some places is very thin (Sydorick, Allen and Jacobs, 2000).

In the last 100 years, unprecedented change in the park’s ecosystem resulting from overgrazing, fire suppression, and drought have caused accelerated erosion of the soil protecting these sites.
The once-grassy meadows that covered the sites turned into denser pine-juniper woodlands with little grass cover, leaving much exposed bare soil. The ancient semiarid soils are relatively thin and eroding at net rates of about one-half centimeter per decade (Allen, 2001; Hastings, et al., 2003). This rapid loss of topsoil exposes the buried heritage and literally washes it away. After a heavy rain, sediment traps intended to measure topsoil loss are often littered with artifacts.

To remedy this, an extensive, interdisciplinary project has been underway to test methods to reduce soil erosion on a landscape level. The Bandelier Watershed Restoration Project is a paired watershed study designed to test the efficacy of a scattered slash treatment. In 1997, a 40-hectare experimental test area was established where crews came in, cut smaller trees, and spread the branches over the ground as slash. The slash directly reduced surface water flow and soil loss and provided a nutrient pulse of nutrients to support the growth of new plants. The response to this tree-thinning effort was immediate. Grasses started growing on the soil in this test area nearly ceased. When this test area was compared to an adjacent control watershed that did not receive treatment, the results were extremely positive: overall herbaceous biomass went up four-fold and sediment yields from sheet erosion dropped nearly a hundred-fold (Allen, C.D. 2001). Based on these positive results, a similar ecological restoration project is taking place now across large areas of the park, with ~2000 hectares treated by 2010 (Bandelier National Monument, 2007).

These landscape-scale ecological restoration projects, as well as the coveat conservation project, are examples of how federal agencies are approaching critical resource issues and the complex interactions between nature, culture, and the built environment.

Figure Captions
1. Frijoles Canyon in Bandelier National Monument, with Tyuonyi Pueblo, a 14th century, stone masonry community house, in the foreground, and hundreds of caves at the base of the cliff walls. (Lauren Meyer, 2003)
2. Documenting a cave with an intact earthen floor that includes a floor ridge and loom anchors, plastered walls, and a passageway to an adjacent cave. (Angelyn Bass Rivera, 2004)
3. A cave interior showing plastered dado, looted ceiling, earthen floor with loom anchors and a niche. (Anton Brick, 2002)
4. Cavates in Long House with remnants of masonry structures in front of them. Note water runoff down the cliff face and into the structures. (Western Mapping, 2007)
5. Laser scanning of cave B002. The computer generated TIN model forms the basis of structural model to predict wall behavior and enable future monitoring. (Angelyn Bass Rivera, 2009)

Volcano and Geothermal Tourism: Recreation or Adventure?

By Panicia Erfurt Cooper

Summary: Volcano tourism has a long history and destinations with active volcanoes guarantee a unique travel experience. The growing interest in active volcanic environments is caused partly by the global trend ‘back to nature’ but also by a curiosity about the geological heritage of unique landforms. Volcano tourism has emerged as a separate tourism sector which is attracting large numbers of visitors worldwide. Many active volcanoes are already important tourist destinations and usually combined with a range of recreational and cultural aspects. In many countries volcanoes and hot springs go hand in hand and the use of geothermal springs for health and medical purposes is generally associated with active volcanic environments. The unpredictable and potentially hostile nature of volcanoes means that risk prevention must be encouraged among visitors with the main objective of making tourism in every volcanic and geothermal area as safe as possible.

Keywords: Cruises, Geoparks, Health, Recreation, Renewable Resources, Thermal History, Visitor Safety, Volcano Tourism, World Heritage

Volcanoes in History and Culture
Volcano and geothermal tourism has been documented in recent times in relation to the European ‘Grand Tour’, which started around 1660 to 1670 with volcanoes and geothermal manifestations often being included in the trip agenda, although it is in fact a lot older (Erfurt-Cooper and Cooper, 2009). Volcano tourism has a long history in countries such as Italy and Iceland where volcanoes like Vesuvius, Etna, Stromboli and Etna, to this day offer unique destination experiences. The original Geyser in Iceland gave the name Geyser to all other spouting hot springs worldwide and the use of geothermal springs for health and medical purposes, which are usually associated with volcanic environments worldwide, also has a long history spanning several millennia (Erfurt-Cooper and Cooper, 2009).

Cultural events and cultural tourism are often closely linked to volcanic areas, with religious pilgrimages to shrines and temples often built near or on the mountains. In Japan the famous Mt Fuji as well as many of the other 100+ active volcanoes are visited for cultural and religious purposes as well as for the natural hot springs (Onsen), which are abundant in most volcanic regions. An official count of hot springs in 2005 records 27,644 hot spring sources (Japan Ministry of Environment, 2006) in 5,500 hot spring areas, and travel to these hot springs of volcanic origin historically goes back many centuries in Japan. Today tourism based on geothermal resources constitutes a major component of the tourism sector with an average of 150 million annual visitors to hot spring destination across the country (Erfurt-Cooper and Cooper, 2009). Large numbers of onsite geoparks enjoy tours to nearby active volcanoes while they are in the area with many of them being repeat visitors (pers. conversations, 2003 to 2008).

There are volcanoes like Krakatau in Indonesia; a volcano with a fixed place in history due to its cataclysmic eruption in 1883 (Furneaux, 1964; De Boer and Sanders, 2002) and is again today on the list of volcanic destinations for adventurous tourists. In the United States of America Mt St Helens is known worldwide because the eruption of 1980 was broadcast on television in nearly every country. This event has no doubt caused an increased interest in volcanism and the quest for information about volcanic and geothermal activity wherever this occurs. Mt Tarawera in New Zealand is remembered as the volcano that destroyed the ‘Pink and White Terraces’ in the eruption of 1886. The famous sinter terraces were fed by geothermal springs heated by the magma chamber underneath Mt Tarawera and were the first premier tourist destination of colonial New Zealand, attracting international visitors until their complete destruction. Other volcanoes that have made negative history are Taal (Philippines), Toba (Sumatra, Indonesia) and in more recent times Mt Pinatubo in the Philippines. However, these are the only volcanic destinations which attract increasing numbers of visitors.
Table 1: National Parks and other protected areas worldwide incorporating volcanic and geothermal heritage.

<table>
<thead>
<tr>
<th>Destination Example (Worldwide)</th>
<th>Annual Visitor Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuji-Hakone-Izu National Park, Japan</td>
<td>110,000 (2004)</td>
</tr>
<tr>
<td>Hawaiian Volcanoes National Park</td>
<td>1,228,040 (2008)</td>
</tr>
<tr>
<td>Vesuvius National Park, Italy</td>
<td>1,000,000 (2004)</td>
</tr>
<tr>
<td>Tongariro National Park, New Zealand</td>
<td>1,000,000 (2004)</td>
</tr>
</tbody>
</table>

Geology

The role of geology includes determining the past, present, and future movements of Earth processes on a range of time scales. Geologists study the history of Earth and its environment through the use of methods such as rock analysis, sediment analysis, and paleoclimatology. Geology is a critical component of environmental science, as it helps us understand the processes that shape our planet and its inhabitants. Geologists use their knowledge to address issues such as climate change, natural disasters, and the search for energy sources and mineral resources. Geology is also essential in the development of new technologies, such as pollution control and renewable energy solutions.

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One of the favourite weekend destinations on the island of Kyushu, Japan, is Mount Aso, a highly active volcano which offers visitors the unique opportunity to drive their cars up to the crater. Other options to view the active crater are to use the ropeway from the lower car park or enjoy some ‘flight-seeing’ by helicopter. Mount Aso is monitored constantly by the nearby volcano observatory and has a very efficient safety system in place. As soon as the wind changes and blows toxic emissions from the crater towards the viewing platforms the area will be evacuated immediately and all traffic to the crater suspended. This however does not stop increasing numbers of visitors spending time with their friends and families at the summit, going for long walks around the crater and having their pictures taken with the colourful crater lake as the preferred backdrop. Not all volcanoes in Japan are that easy to access, but most of them are popular tourist destinations.

Volcanic Islands

Cruises among Volcanoes

Colder regions including polar environments also offer volcanic and geothermal adventures; in Antarctica for example cruise ships include a visit to the volcanic caldera of Deception Island in their trip agendas, where passengers have the option of soaking in a very hot spring on a very cold beach – one of the highlights for most travellers and a great bonding experience.

In the northern Pacific cruise ship holidays are advertised as ‘Cruising the Northern Ring of Fire’ with trips including the volcanic island chains from Alaska’s Aleutians to the Russian Kamchatka and the Kuril Islands down south to northern Japan. These cruises offer their passengers not only volcanic viewing and geothermal attractions like hot springs and geysers, but also a wide range of activities including anything from wildlife encounters including bear and bird watching, canoeing, fishing, and mountaineering, depending on the physical condition of the tour members. Information sessions and presentations about the geology as well as the ecology of the unique environments are frequently offered as part of the service on board the cruise ships.

In Japan millions of people visit the sacred Mt. Fuji; in Hawaii the ceremonial events to honour the volcano goddess Pele attract large numbers of tourists and so do the appeasement festivals in Indonesia. In the Philippines and Vanuatu volcanoes are marketed as key tourist attractions and in the Caribbean the volcanic island arc of the Lesser Antilles (St. Vincent, St Lucia, Martinique, Montserrat, Dominica) enjoys the growing interest in active volcanoes. The Canary Islands, Cap Verde Islands, the Azores and Madeira are also very popular volcano-based holiday destinations. In Greece the islands Santorini and Nisyros attract visi-
The Exploration of Unique Landforms

Many of the active volcanoes (approximately 1300 worldwide) and associated geothermal areas are already important tourist destinations. Glowing lava flows, strombolian eruptions and fissure eruptions are among the most sought-after tourist attractions. Night tours to popular viewing spots are offered by some tourism operators as part of the itinerary for better viewing effect. In order to attract as many visitors as possible, a diversity of tours with varying levels of difficulty and risk factors are promoted. They include a) day trips to volcanic and geothermal environments, b) excursions or field trips of several days or weeks as well as guided excursions to explore unique locations (Erfurt-Cooper and Cooper, 2010, in Press).

Hiking and Trekking

Tourism destinations with active volcanoes are considered unique destinations and guarantee an outstanding travel experience. Social and cultural interaction is playing an increasing role at destinations with Hokkaido in Japan a great example. Here hiking and trekking on the volcanoes of the northernmost Japanese island with its many national parks is combined with ice-climbing for the more adventurous minded, skiing and snowboarding as well as hot spring bathing for the socio-cultural and recreational element of the experience. In New Zealand the volcano Mt Ruapehu is a popular destination for winter sports such as skiing and snowboarding. Occasional eruptions have not deterred the numbers of tourists who flock every winter to the slopes. The same goes for New Zealand's Tongariro National Park, where unique volcanic landforms attract vast numbers of tourists who set out to tackle the 'Tongariro Crossing'.

National Parks, World Heritage, Global Geo-Parks and other Protected Areas

Volcanic environments are often located within protected zones or national parks (NP) and in addition a number of them also have World Heritage status (e.g., Auckland Islands, Italy; Hawaii Volcanoes NP; Jeju Volcanic Island, Korea; Surtsey, Iceland; Teide NP, Spain; Tongariro NP, New Zealand; Volcanoes of Kamchatka, Russia; Yellowstone NP). In Indonesia the close proximity of the World Heritage site Batur Volcano and other active volcanoes attracts a combination of visitors for cultural tourism, geotourism and volcanic tourism. The UNESCO Global Geopark Network has recently (August 2009) officially recognised 3 new Global Geoparks in Japan; with two of them featuring highly active and potentially dangerous volcanoes as their focal points of attraction: Mt Unzen on the island of Kyushu and Mt Usu on the island of Hokkaido. Both areas have seen disastrous eruptions over the last 15 years, but they are firmly integrated in the regional tourism sector and also the cause of the multitude of geothermal springs the Japanese people are so fond of. The new Japanese UNESCO Global Geoparks are clear evidence that active volcanoes do not deter visitors but draw tourists to eruption centres; especially if these are combined with other popular recreational attractions.

Volcanic landforms which are presently dormant or assumed extinct are also part of the volcanic tourism sector. These areas are often located in national parks and marketed as family friendly destinations offering outdoor activities for everybody. Examples of dormant volcanic regions are the Glasshouse Mountains in Australia, the Vulcanoefiel in Germany, the Auvergne in France, the volcanic landscapes of Turkey, Greece and Spain to name just a few. But all these areas are well known tourist destinations by interest; however, the site of Nisyros (Greece) or exploring the Campi Flegrei in Italy is a common part of the trip agenda.

Renewable Resources

Thermal Waters for Health and Wellness

Hot springs for recreation, health and wellness are commonly found around volcanoes as an additional special attraction in countries like Italy and Iceland where volcanic and hot springs go hand in hand as they do in New Zealand and Japan.

The utilisation of natural hot spring water of volcanic origin for health and wellness as well as for commercial purposes is common in countries with an abundance of geothermal resources, although the sustainability of these resources can be affected by over-exploitation. This has happened in Rotorua, New Zealand, where in the past excessive use led to a reduction in pressure of the local hot spring water supply. However, remedial action has led to renewed availability under controlled usage. But the government sanctioned geothermal power station Wairakei is said to have contributed in a big way to the deterioration of the geothermal features of the Wairakei Geothermal Valley, once a popular tourist attraction, which today has a replica of the original silica terraces that disappeared with the development of the geothermal power plant in the 1950s (Frommer's, 2009).

In most countries worldwide geothermal water resources are available; sometimes only at lower temperatures and not always related to volcanic activity. The occurrence of large reservoirs of geothermal groundwater can encourage the development of thermal spa facilities, hot spring resorts or aquatic entertainments centres. The Guarani Aquifer in South America for example, which underlies the countries of Argentina and Uruguay, is supplying hot spring spa industry with geothermal water via artesian wells, and is contributing significantly to the local economies in both countries (Erfurt-Cooper and Cooper, 2009). In Germany the protocol of a regional inheritance has a long history in using natural hot springs for medical applications. France and Italy, Greece and Turkey, Russia and Hungary – wherever there are geothermal resources people will make use of them, not just for health and wellness, but also for commercial purposes.

Safety and Risk Management - Education, Public Awareness

The unpredictable and potentially hostile nature of active volcanic and geothermal areas means that risk prevention must be encouraged among visitors. To achieve this is an important first step for further investigation because volcano tourism as a whole is under-reported, although in tourist numbers this special interest area is increasing. Scientists and tourism operators need to collaborate for the benefit of effective risk management.

Visitors to volcanic environments are not always prepared for unexpected emergencies, and therefore safety guidelines and instructions for emergencies should be designed with the inclusion of temporary visitors in mind. This specialised information should be available at all volcanic and geothermal destinations in the form of hazard maps and instructions for emergencies to prevent unnecessary accidents. In order to be more aware about the potential danger of volcanic environments visitors need to know beforehand how and where to find help and whom to contact in an emergency. Communication in remote areas can be a problem, sometimes with dire consequences for the visiting tourist, especially if there is a lack of signage as well (Erfurt-Cooper and Cooper, 2010, in Press).

Several years of field observations and interviews of tourism operators in a number of countries by the author have revealed that many visitors (most likely the majority) of active volcanic environments are not well informed about any potential risks, or what to do in case of an 'unscheduled' eruption. In fact, risk management in active volcanic and geothermal environments is extremely challenging due to the varying degrees of potential danger, which can generate different types of hazards. Ash fall, lahars, pyroclastic flows, gas emissions and earthquakes during volcanic eruptions can lead to serious injuries. Perhaps the most common threat is the point of asphyxiation or thermal burns from steam vents or extreme hot springs are only a few examples. Remoteness, difficult terrain and adverse climate conditions can also be a problem when evacuation has to be conducted in an emergency. It is therefore imperative that potential dangers
of active volcanic and geothermal environments are highlighted for the safety of the visitors. Ironically, the associated risks and potential dangers of volcanic and geothermal activity are just the situations which promise a unique experience, and are therefore highly attractive for the tourist, while many volcanic areas are classed as extreme environments. In order to achieve higher levels of protection, adequate safety guidelines are required for every volcanic region; especially when visitors are inexperienced and not familiar with the geophysical environment of active volcanoes (Erfurt-Cooper and Cooper, 2010, in Press).

Rak perception and risk assessment by individuals are significant factors in both risk creation and risk perception. This leads to the question whether tourism close to active volcanoes should be encouraged and promoted. The answer is a cautious yes, under the condition that acceptable risk management strategies are in place and increasing visitor numbers do not put the surrounding natural environment under additional pressure (Erfurt-Cooper and Cooper, 2010, in Press).

With a large number of active volcanoes being monitored to date however, the risk remains serious and visitors need to be aware of the environment they are entering. In many countries signage is a problem as most signs are only in the local language, which does not bode well for uninformed visitors who do not speak or read this language. Local residents in active volcanic regions are generally made aware of any potential dangers and hazards, but travellers rarely have this information and are usually not aware of local safety guidelines, escape routes, location of emergency shelters, and evacuation procedures (Erfurt-Cooper and Cooper, 2010, in Press).

Concluding Remarks

The trend to discover unique natural settings has led to new forms of tourism such as geotourism and volcanic tourism. With a growing interest in more adventurous destinations, active volcanic and geothermal environments take a special place on trip agendas and attract increasing numbers of visitors worldwide. The main objective is therefore to make tourism in every volcanic and geothermal area as safe as possible, with as much information available as possible. This could be considerably advanced through the development of international safety guidelines (internet-based) for visitors of all active volcanic and geothermal environments (Erfurt-Cooper and Cooper, 2010, in Press).

References


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Is the preservation of life an obligation for Contemporary Architects both in The Galapagos Islands and worldwide? Since the Neolithic Revolution, man has been creating artificial spaces that gradually became their "natural" environment. For modern generations, the city, with its wide avenues and buildings, has become its habitat; its "new nature", ironically detached from ecology. In which the artificial and mechanical elements are the geographical area where man lives and continues to pursue life. In this century, cities around the world have reached its maximum and complex greatness. Architecture, engineering and rapid technological advances have come together to build stately avenues, fine buildings, and countless other electromechanical infrastructure. Although these advances have made an easier transportation and everyday task they have also made a serious impact on ecology. The uncontrolled expansion of the urban environment has significantly deteriorated until the point of endangering life on earth. This has prompted, in many places, the search for new constructing alternatives from the typical standard modes of production of buildings. Faced with the loss of essential resources for life, some few architects, instead of solving self-absorbed spaces enclosed within four walls, are creating spaces inspired by natural/organicism forms, spaces of the re-creation of nature and some others are even proposing sustainable homes made from recycle materials, set-up Islands Commission of the International Geographical Union has 12 members, including academics based in mainland France, Germany, Greece, the Netherlands, Sweden and USA. The 'island studies reader' which I edited in 2007 has around half of its content penned by mainlanders - Americans, Australians, Canadians, French, Swiss, Swedes - none of whom, as far as I can tell, reside on islands - in spite of a deliberate attempt by the editor to "provide platforms to other contributors" (Baldacchino, 2007a: 2). Embarrassingly, there are indeed "... few indigenous rant McCull (1994, 1996a, 1996b, 1996c), defined Nissology as the study of islands on their own terms. The concluding phrase - "on their own terms" - suggests a process of empowerment, a reclaiming of one's histories and cultures, particularly for those islands which have endured many decades of colonialism. After all, "[Continental] covet islands". McCull reminds us, while "[Islanders themselves and their way of seeing things is not much appreciated" (McCall, 1996a: 1, 2). It is, therefore, time for a change, also in the interests of political correctness. And yet, the opening segment of that same definition - "the study of islands" - marks an uncomfortable relationship, intimating that the process of inquiry may still be directed by outside forces, although presumably more well-meaning ones. 'Island studies' is explained not as a pursuit by islands, or with them, not even for them, but of them. The production of buildings with reutilize resources is a striving proposal of an American architect. While there are a great number of issues and problems facing the fragile environment of the Galapagos, there are successful stories and potential solutions as well. With the intention to keep the good efforts for the preservation of the The Galapagos Islands,!?E.M - Galapagos Institute of Village Ecologies is promoting a didactic project under the guidance of Michael Reynolds to develop a global sustainability institute/village on the island of San Cristobal.

Reynolds is an architect and principle of Earthship Biotecture, a global practice based on 40 years of research and development of "radically sustainable living" with 1200 earthships built worldwide. The architect is also known as the "Garbage Warrior", thanks to the 2007 documentary which celebrates his life and work. Reynolds describes his creation, an Earthship, as an autarlic building - completely self sufficient for water, sewage, electricity and heating which is built up from reclaimed or natural materials like car-tires, earth, bottles and cans.

With the rise in concern over global warming, Reynolds has become a prophet of the green movement. Through Reynolds vision the Institute of Village Ecologies will proceed beyond the restrictions of conventional building for the urgent purpose of global demonstrations toward sustainability and carbon zero development. With the introduction of this sustainable village The Galapagos Islands will demonstrate leadership by incorporating environmentally sustainable practices into local governance to promote preservation of natural resources, energy conservation, elimination of waste and emissions, and diminishment of negative impacts on the environment.

To be part of this village will involve all aspects of living, integrated with an educational plan, where the act of living becomes an ongoing learning experience and an art. The village will provide learning and living spaces for all ages of people. It will supply temporary accommodations for students and permanent accommodations for residents of the Galapagos Islands. As part of the public spaces there will be a grand hall, gallery, classrooms, studios/ workshops, hotel rooms and some permanent homes for institute and hotel staff. The village will provide its own utilities and food based on the globally sustainable principles currently established by Earthship Biotecture. There will be an emphasis on reducing the distance travel by any given product or material used in the village, therefore lowering the carbon footprint of those products and materials;

To influence and inspire the rest of the world, people from all the countries on earth will be invited to live and learn and pursue the work of
the Galapagos Institute of Village Ecologies (G.I.V.E.), due to all their experience it will act as a sister project to this institute.

The sustainable, green building, carbon zero education starts on the first day on the building of the first modular structure. Other aspects of general education will come as the project grows. This allows for the immediate generation of students, interns and some free labor to help with the first phase of building. Various companies from around the world can get carbon credit from providing tuition for interns, students to help build the project and from donations to the project.

As shown above, the paper set out to understand that architecture can be a useful tool to make small, believable steps toward slowing down and reversing the negative impact of human development as it relates to the Earth’s ability to continue to support life. In the process, architecture has the potential to act as a catalyst for change, at the same time engaging and learning from those of the community. Architecture on its own it’s not a solution. For ownership to take place, it implicates the culture and its people, as well as the relationship between the architect and the community. Building relationships fosters trust and confidence, and guides the architect’s intentions to build sustainable environments for the “Three Ps: People, Planet and Profit”.

**INSULA's PAGE**

1st world conference, Volcanoes, landscapes and cultures
Catania 11-14 November 2009

The Conference held under the auspices of unesco, the council of Europe, the Italian Presidency of the Council of Ministers, took naturally place in Sicily at the foot of Mount Etna, the largest active European volcano.

The Conference, the first of its kind, addressed from a holistic and multidisciplinary point of view the core aspects of the relationships between humankind and the obscure turbulences of the mineral world. More than hundred specialists of various disciplines together with public authorities gathered in Catania in order to respond at an International level to the increasing need for development policies addressing the natural and cultural heritage represented by volcanic landscapes and territories, not only for the populations presently living at their slopes, but for mankind all together. Unesco by the way, has attributed recently the prestigious title of World Heritage Site to some exceptional volcanic landscapes such as the Aeolian Archipelago, off the north east coast of Sicily.

The experiences recalled by the debates included a variety of themes concerned with natural and earth sciences, specialized agriculture, archeology and culture, cinema and literature, vulnerability and civil protection, up to the economic potentials of volcanic areas including the increasing importance of tourism in such territories.

Several proposals were put forward by the participants such as the creation of an international scientific network for the development of volcanic territories. A name was evoked, Ephesus, the clever Greek God of forges and fire. There is much more. Would you know more, visit the Conferences website: www.etnacatania2009.com, or address to the Conference’s International Secretariat: Insula – M. Larabi; mailto insula@insula.org

Some participants to the Conference
Volcano and Geothermal Tourism
By Patricia Erfurt Cooper

There are over 1300 active volcanoes worldwide and many more dormant or extinct. Some are developed as tourist destinations; others are not, but have great potential. Mount Fuji in Japan attracts over 100 million visitors per year and has immense cultural and spiritual significance, while a number of volcanic areas in national parks, for example Teide in Spain, Yellowstone in the US, Vesuvius in Italy and Tongariro in New Zealand, attract between one to four million tourists each year. In the last decade the designation of nearly 50 geoparks around the world has highlighted their potential for tourism development.

This book provides the first global review and assessment of the sustainable use of active and dormant volcanic and geothermal environments for geotourism. The volcano-based tourism sector is further augmented through a closely linked range of geothermal resources and attractions, such as geysers and hot springs, which are discussed in detail throughout individual chapters covering all key volcanic and geothermal regions around the world. It is shown that

volcano and geothermal tourism is a subsection of nature-based geotourism and incorporates a variety of other tourism categories such as adventure tourism, extreme tourism, ecotourism, green tourism, educational tourism, and hot spring tourism. This comprehensive book covers the most important issues of this growing tourism sector while incorporating relevant global research, making it an essential resource for all in the field.


Besoïn d’Îles
By Louis Brigand

Louis Brigand wished to escape from doctoral conventions. What he proposes us here, is a life of researches told as a journey.

How he discovers the Iroïse Sea. How he becomes attached to all the appeared lands, with a preference for the temporary islands, those which appear only the time of a tide. How, from the island he passes in insularity, going to observe people who, far from any sea, are islanders because of their isolation. How it pulls him in Siberia, or Chile. How, finally, we attend the

metamorphosis of our familiar islands from which the populations go away and are replaced by loving tourists.

Earth of solitude, earth of exile, earth of autonomy, the island speaks to us about the essential. Louis Brigand, with sincerity and simplicity (even if the scholar is never far) evokes our common history.


The International Scientific Council for Island Development (INSULA) was formerly created in November 1989 as a non-governmental organization (NGO) whose aim is to contribute to shape island awareness and develop islands' common future, supporting necessary cooperation and information actions in the scientific and technological fields.

The aims of INSULA are to provide training and a supporting role for national and regional level and the protection of the environment and the sustainable development of their resources. Within such a context, INSULA cooperates with UNESCO, the European Commission and other international organisations, as well as institutions at the national or regional level sharing the same goals of interests. Through its international and multidisciplinary network of experts and researchers, INSULA contributes towards building sustainable development initiatives undertaken by island authorities.

INSULA publishes a twice a year "The International Journal of Island Affairs". The aim of this journal is to create a world forum for all those who consider islands as an important part of mankind's heritage deserving major attention. "The International Journal of Island Affairs" is sent, free of charge, to the members of INSULA.

The membership fees are:

- 70 euros for individual
- 190 euros for institution

Payments can be made by check (in euros only), MasterCard, Visa or American Express (please indicate card number and expiration date).

Back issues are also available for 8 euros each (plus shipping costs).

Please visit our website www.insula.org for more informations about our publications, projects and actions for which INSULA’s membership is invited to play an active role.

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