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ARCHAEOACOUSTIC ANALYSIS OF THE ANCIENT TOWN OF ALATRI IN ITALY

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Abstract

SBRG's research of archaeoacoustic and physical phenomena at ancient sites has developed over a number of years. Our research group uses a practical standard (SBSA) which complements the field of archaeology. Studying archaeoacoustics and natural phenomena over the last five years, it has enabled us to offer an explanation of some of the enigmas of ancient archaeological sites that were not previously possible to explain using other methods.

Following our experience, we utilised the same archaeoacoustic methodology to study the town of Alatri in Italy. The present Cathedral of Alatri stands at the highest point of the town underneath which lies a Cyclopean temple. We sought to understand why such a temple was built on top of the hill. Using our SBRG protocol we discovered very strong and significant low vibrations (seismic waves) continuously

* SB Research Group (SBRG) is an international and interdisciplinary project team of researchers (Italian, Croatian, Serbian, English and Finish members) researching in anthropology and archaeoacoustics of ancient sites and temples in Europe (www.sbresearchgoup.eu).

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emitted from the subsoil. Our hypothesis suggests the exposure to such vibrations in the absence of noise could have a significant effect on the psyche of those who came for prayer and meditation, facilitating access into a mystical state. Even though ancient people did not own the same equipment we have today, they would have been aware of the conditions required to achieve such a mystical state, perhaps by simply sensing they were closer to God in a given location. The seismic waves would appear to arise from the geological fault located on the side of the hill where the town has stood since ancient times. The presence of these seismic frequencies would have increased the effect of rituals by enhancing the psyche of the participants due to the influence of these low vibrations on human brain waves. This suggests the builders of this temple had some sort of knowledge of this effect and offers a possible explanation as to why the temple was built in that particular location.

Keywords: archaeoacoustics, Alatri, polygonal walls, low frequency sound, infrasound, SBRG, SB Research Group

1 INTRODUCTION

Archaeo-acoustics or archaeoacoustics is a complementary discipline of archeology and anthropology which may help expand our understanding of why certain sites were considered sacred in ancient times. It may also help to explain why ancient structures were built or carved into the rock. Starting from the premise that past ages were not devoid of noise or spent in silence, we know the human voice used in songs along with the vibrations produced by the musical instruments remained the highest expression of culture for a long period. Natural sound phenomena were used in several civilizations to create impressive rites, with some ancient structures modelled in a certain way to directly influence the mind through the vibrations they produced towards a particular state of consciousness [7, 8, 10].

Figure 1 A winter image of Alatri taken from the hill in front of it.

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In previous research, SBRG demonstrated a relationship between mechanical vibrations from resonance phenomenon at some Neolithic temples and brain activity [5, 6, 9, 10, 11, 12]. Any severe and artificial extreme sound imposed on the sonic environment has a profoundly destabilizing effect on the individual, indeed infrasound has been used in the context of wars in the area of acoustic weapons [6]. However, natural low vibrations with an absence of high pressure can have a positive influence on human health and some people can perceive very low-frequency sounds as a sensation rather than a sound [6]. Infrasound may also cause feelings of awe or fear in humans and given it is not consciously perceived, it may make people feel like strange or supernatural events are taking place [16]. So it is possible to hypothesize that where a lot of natural low vibrations are present, ancient populations considered these sites to be "sacred" [6]. Through archaeoacoustical analysis, it is possible to demonstrate there was some knowledge of acoustic phenomena in the past, which could for example have been used in ancient rituals [5, 6, 7, 8, 9, 10, 11, 12]. This same analysis was applied to the historical Alatri town.

2 THE ANCIENT TOWN OF ALATRI IN ITALY

This ancient town is nestled among the hills one hundred miles southeast of Rome, Italy and features a Cyclopean acropolis on the peak of the hill it sits on. A number of researchers say its origin dates back to a pre-roman period, but the exact date it was built has not been determined [1, 2, 3, 4, 13, 14].

In the 1980's don Giuseppe Capone, a monk born and raised near Alatri and served for long time in its church-seminary made some archaeo-astronomy observations. Over several years he studied the astronomical and geometrical parameters that might have been incorporated in the original design of the town. These observations were confirmed by Antony F. Aveni, professor of Astronomy and Anthropology at Colgate University (USA) in an article in collaboration with don Capone in 1985 [1].

The ancient Indo-Europeans point of the reference was the sun. Using it, they fixed certain points on the horizon that were important in their religion. The founders of Alatri evidently employed this system for their city, which is a remarkable place, because it lies undisturbed with its original Cyclopean surrounding wall elongated along a North-South axis centred precisely on a solitary rock outcrop, a little higher than the acropolis. This outcrop was the sacred space reserved for cult activity, the veritable "altar of sacrifice". They divided the entire city into quadrants centred on this rock outcrop, now visible at the north side and immediately to the exterior of the cathedral of Alatri, built over the Cyclopean foundation of the ancient Temple of the Sun, placed in the centre of the acropolis [1].

That the outcrop may have been employed as a fundamental reference point in the construction of the city is further suggested by the following astronomical observation: early in the morning standing on the central rock outcrop facing North, one sees the sun rise at the summer solstice; the corner of the wall of the acropolis casts a shadow that points directly to the outcrop

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of rock. Furthermore, the segment of wall on the east side, the length which is terminated by this event, turns out to be the fundamental unit of linear measure used in the construction of the town; all the gates and archways in the outer wall (with one exception) lie equidistant from the rock outcrop at three times the length of this eastern inner wall (see Figure 2).

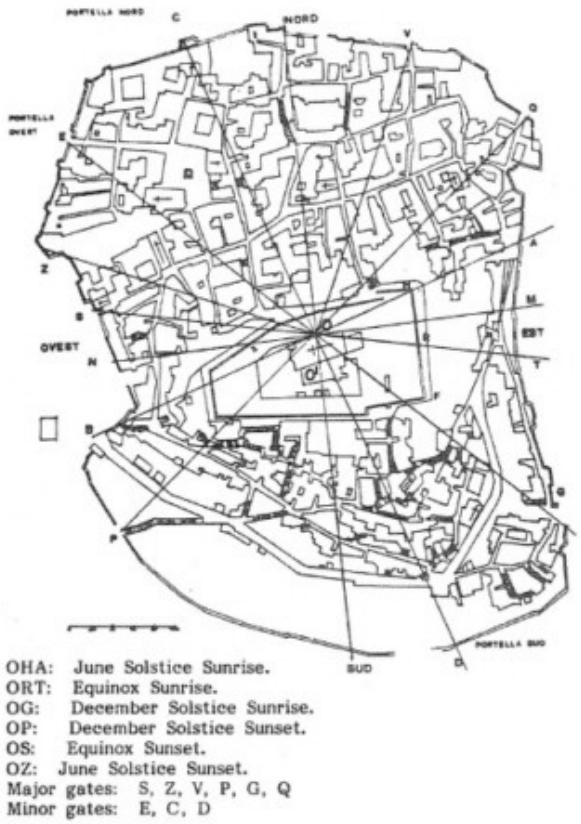

Figure 2 The map of Alatri showing astronomical and geometrical indications [4].

That point, therefore, becomes the ideal geometric centre from which the actual construction proceeded [1] and is the so-called “navel” of the town. At the summer solstice sunset, the sun illuminates the city gate of the superior northwest quadrant and its shadow is directed toward the central outcrop as was the case that same morning. But also another gate in the right inferior quadrant looks very interesting. It is located at the bottom of a long and narrow corridor with tight steps and it is called Minor Gate or the “Gate of three phallus” for the symbols carved over it. In the morning of the equinox in March and December, the sun illuminates the stairs to the end of the corridor with the sun light drawing a perfect rectangular shape outside the door (see Figure 3) [1].

Based on our archaeoacoustic experience of European ancient sites [5, 6, 7, 8, 9, 10, 11, 12] we decided to analyse this Italian site starting from the rocky outcrop that looks like an important point of reference for the architect

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of this town. Our aim was to discover why the Alatri acropolis was built on that particular hill as opposed to the surrounding hills. Did this hill exhibit "sacred" characteristics found at other sites, if so why did the builder consecrate the acropolis with such characteristics?

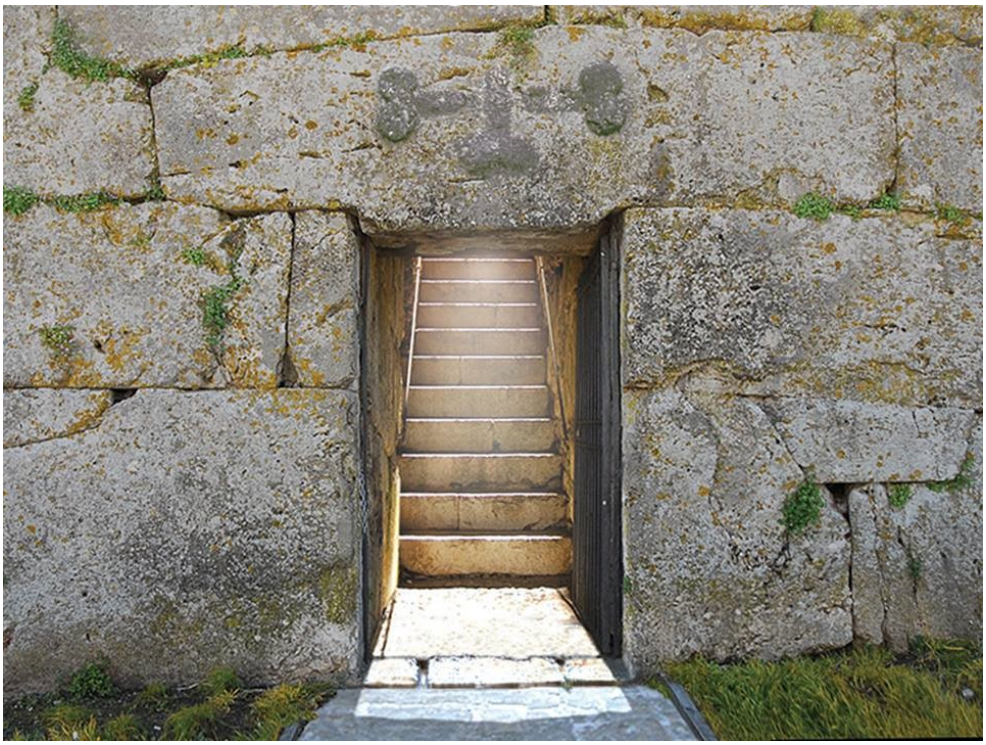

Figure 3 The Minor Gate at the equinox, with the sun lighting up the stairs, drawing a perfect rectangle on the stones in front of it. Over the gate there are three phallus carved on the stone architrave (courtesy of Ornello Tofani, Italy).

3 MATERIALS AND METHODS

The experiment was carried on using two different methods of investigation: a) audio recording the full audio spectrum; and b) TRV technology over three visits in different seasons. This dual investigatory method had been previously used at another archaeological site in Italy [12].

The audio recording was performed following the SBRG Standard for archaeoacoustics – SBSA [8]. In this case the equipment consisted of a high range dynamic recorder, extended in the ultrasound and infrasound field with a sampling frequency rate of 192 kHz (Tascam DR-680). Condenser microphones with a wide dynamic range and flat response at different frequencies (Sennheiser MKH 3020, frequency response of 10Hz to 50,000 Hz) with shielded cables (XLR Mogami Gold Edition) and gold plated connectors.

We placed the microphones at a number of different locations around the acropolis and in the surrounding area to detect if similar vibrations were

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present at other locations in the neighbourhood. We have to remember that low frequencies or infra-sounds (seismic waves) are non-directional and are not absorbed that much by the soil, which means they can travel long distances.

We have used audio devices in our archaeoacoustic research since 2010. However "TRV technology" (Variable Resonance Imaging Camera) is something we have only just begun to use and therefore needs an explanation as to how it was applied in our research and how it might be applied within the wider archaeoacoustic field. It is important to understand there is a direct correlation between emotional and functional states of the human body with the precise parameters of controlled motion reflection. Until recent times quantitative parameters and efficient information of the movement of the human body were not established. Bernstein and Mira Lopez (psychodiagnostic miokinetics) [15] studied the micro-mobility of the human body and found that it represented a sophisticated mathematical problem. For example, it has been shown that the vertical balance of the human head is controlled by the vestibular system, described as a reflex function, but the balance of the head can also be considered an extension of locomotor activity (micro-mobility of the head) controlled by this system. The analysis of this and other types of reflexes which control our bodies' mobility provide a lot of information on the state of conscience of the examined subject. From a physical point of view, the mechanical oscillations of the head are a vibrational process, whose parameters provide a quantitative correlation between energy and mobility of the object. Information on the integral parameters of head mobility can be obtained using video analysis TRV (Variable Resonance Imaging Camera) technology, which provides quantitative information of the periodic movements of any part of the imaged object.

In the image provided on the primary monitor (represented by pseudo-colours), each point represents the mobility parameters in the frequency of the examined subject. As in other biomedical imaging (ultrasound, NMR, IR, X - ray), the TRV is a method of image analysis that is based on data of micro-mobility models and introduces a new term, emotional vestibular reflex or "reflection of vestibular energy" (RVE). This indicates that the coordination of the movement depends on the emotional and physiological state of mind affected by these factors. To date, the system has primarily been used in the security and anti-terrorism field, whereby people in an agitated or stressed state of mind have a different colour around them compared to those in a normal state, this helps to identify them amongst a group of people.

The TRV image analyser system is used to monitor vibrations in normal or altered states of conscience, the so-called Human Energy Field (Human Energetic Field - HEF). In a little square on the PC screen the image of the subject is shown using a spectrum of false colours, with a graph corresponding to the initial position. Later the software shows through a variation of image colours, a transition to an altered state of conscience sometimes resulting in a change of colour to a single colour tone or the total disappearance of the image itself. The change from the initial multi-coloured

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image to a single colour state indicates that the vibrations have passed from a wide spectrum to a narrow spectrum of frequencies, which indicates a state of coherence in the examined subject. We can therefore state that the detected frequency spectrum changes completely when the examined subject enters into an altered state of conscience. All the parameters are analysed and stored from moment to moment by the cameras software. At the end of the trial a "report" can be generated showing the spectrum of vibrations, which shows the depth of meditative state achieved along with any fluctuations of intense vibration in the body of the subject examined.

Figure 4 The TRV system used in the experiment (courtesy of IPERLAB Laboratory, Italy).

The pictures in Figure 5 show a distribution of horizontal coloured stripes around the vibrating objects (rows show obtained individual frequencies). These represent the spectral distribution of vibrations in a band between 0.1 and 10 Hz according to a scale of pseudo colours from purple to red (shown below).

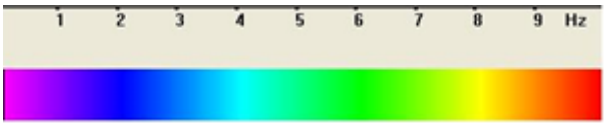

Figure 5 Images converted to a scale of pseudo colours in relation to frequency measured in Hz.

The vibrations generated throughout the human body vary continuously both in amplitude and in frequency. On the computer screen a large panel shows someone with horizontal coloured lines of varying lengths surrounding them, highlighting the vibrations detected (Figure 4). The frequency is

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represented using colour scale (Figure 5). Another panel in the bottom left of the screen, shows the spectral characteristics on three graphs.

The TRV camera recently received a quality certification for scientific use. The TRV system aims to study the functional state of the human body through recognition and mapping of the emotional state. The algorithms for determining this are based on a mathematical statistical system, the coordination of movement principles and the logic of behaviour psychology using comparative tests.

The TRV system's camera has a common backlighted screen with a three CCD MegaPixel sensor. The protective anti-aliasing filter was removed to extend its vision beyond visible light into the infrared (IR) and ultraviolet (UV) range. It has a system of rotating LEDs from infrared to visible light which generates ultraviolet light and synchronises it to the lights rotation at will from 1 Hz to 10 KHz. The lens is a 25 mm quartz-fluorite with passband from 200nm to 1800nm. It is connected to a PC, but videos can also be saved to internal flash memory.

We used this system not only to evaluate the emotional state of volunteers on the top of Alatri hill, but also to visually confirm the subsonic vibration detected on two previous occasions, as this device is also capable of identifying low vibrations from the environment. This extended application is open to criticism, because it is not the original intended use for which the device was invented.

4 RESULTS

At the end of August 2014 we undertook our final archaeoacoustical survey at the archaeological site of Alatri. After a year of research and three visits, we confirmed acoustic data previously collected using the survey digital recorder along with new discoveries with the Variable Resonance Imaging Camera (TRV).

We had previous experience using this equipment undertaking research at the Hypogeum of Cividale del Friuli [12]. In this study the TRV system was used to graphically confirm the presence of intense infrasounds (seismic waves) at the Acropolis in Alatri, that were also present inside the second walled circle. This confirms the importance of acoustic data obtained using our ultra-sensitive microphones.

The Resonance Variable Imaging Camera is a special type of camera designed to see both infrared and ultraviolet bands with the aid of a computer. Using dedicated software, it is capable of making optically visible subsonic vibrations (infra-sounds) between 0.1Hz to 12Hz, frequencies that are not usually perceived by human sight. When Alatri is viewed from the hill in front of the Acropolis, the whole city vibrates in a subsonic way, which is in contrast to the surrounding mountains. The largest concentration of low-frequency vibrations were visible from inside the acropolis and the "navel", located in the north of the church, built over the Cyclopean temple. Below are several images taken with different photographic equipment.

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The image in Figure 6 shows Alatri taken from the opposite hill, the contrast was increased using resident software found inside our professional Olympus E-5 digital camera. Pay attention to the tree foliage on the bottom left of the picture.

Figure 6 Picture of Alatri taken from the opposite hill.

The image in Figure 7 was taken using an infrared digital camera the same and angle as the first. This time, the tree foliage is white because the leaves absorb infrared rays.

Figure 7 The same shot as figure 6, but using an infrared camera.

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The image in Figure 8 is the most interesting, it was taken with the Resonance Variable Imaging Camera (TRV) and consists of the standard deviation of thirty images taken from the same view. In it the vibrant part of the hill, or rather the whole hill is in red colour, so too is the tree foliage in the lower left corner, caused by the wind moving the leaves and branches. The surrounding hills appear black since they are not subject to the same vibration as Alatri hill.

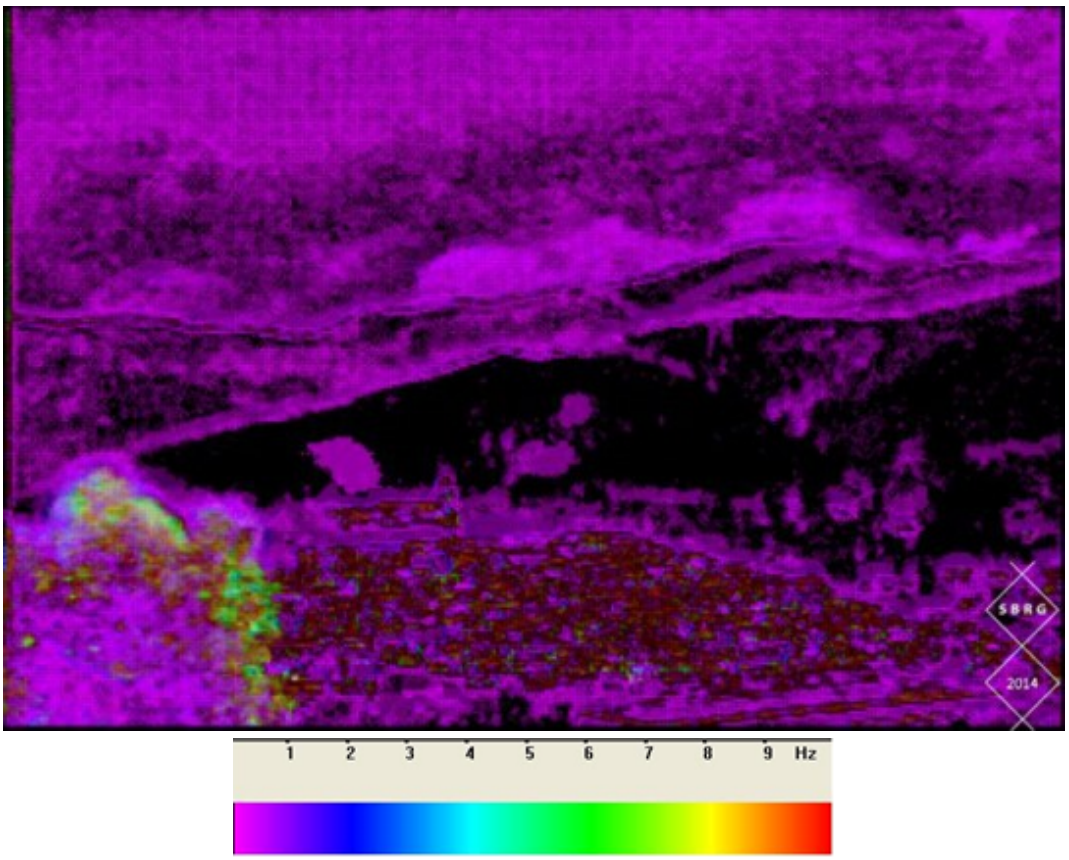

Figure 8 Alatri hill from the same view point, but taken with the Variable Resonance Imaging Camera (TRV): the red colour indicates a vibration frequency of approximately 9-10Hz, as can be seen from the reference scale under the main image.

This data is comparable to that taken by the ultra-sensitive microphones recorded by two different TEAC Tascam digital recorders. There is a large volume of infrasound vibrations affecting the whole of Alatri hill in the range of 8-9Hz. In addition there is a frequency in the audible field band of around 32Hz that was found in previous missions, which most likely represents a harmonic of the main vibration.

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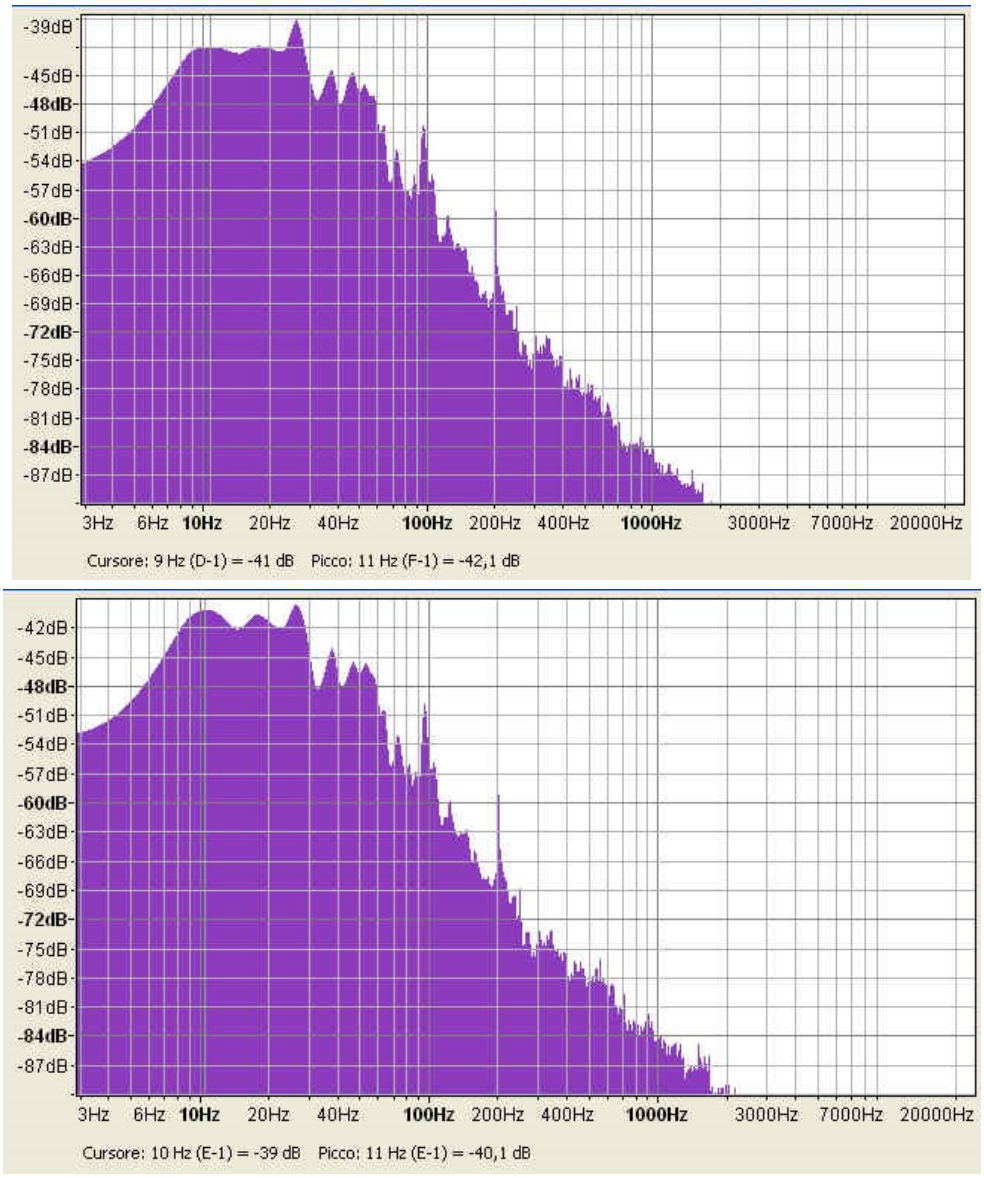

Figure 9 Plots of the vibrations coming from underground taken at difference times inside Alatri Cathedral. The foundations of this church dedicated to St. Paul was made from the walls of the ancient pagan temple. In these graphs the frequency peaks at around 8-11Hz and 30-32Hz are visible.

Thanks to the Resonance Variable Camera, we also observed other interesting phenomena at Alatri. For example, there are also other vibration frequencies affecting the whole acropolis and the cathedral in particular. It seems that there are simultaneous peak frequencies below 4Hz capable of generating fields of vibration in the air.

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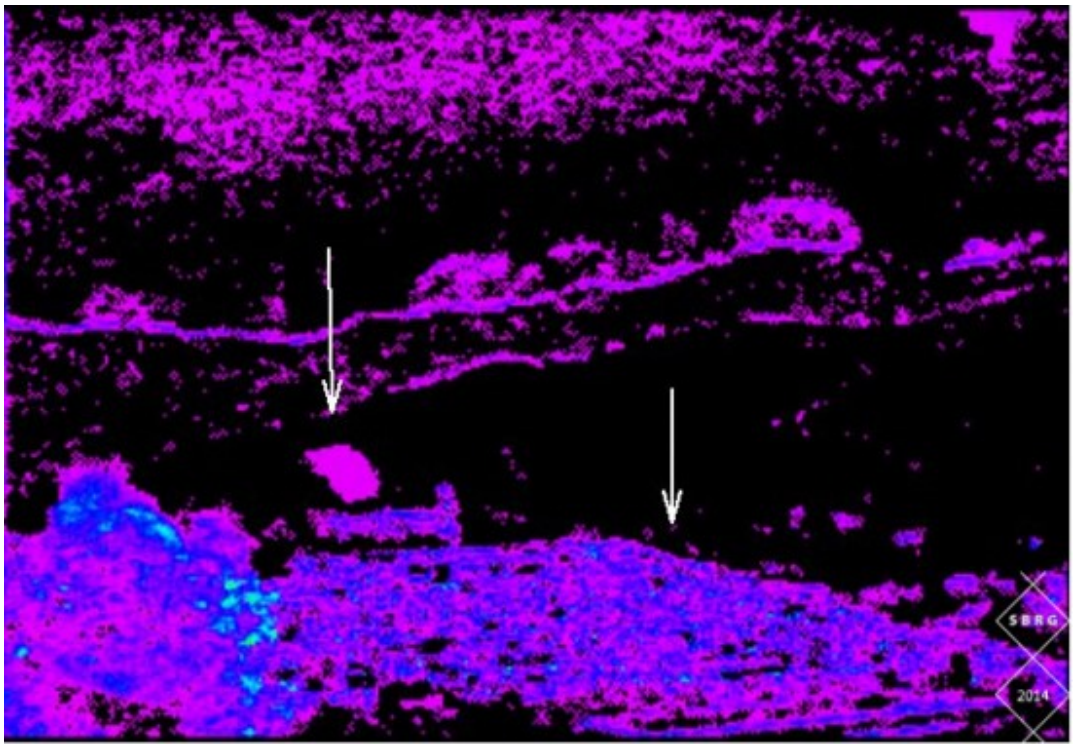

Figure 10 View of Alatri in the blue-violet colour palette as taken by the Variable Resonance Imaging Camera. The arrows indicate the resonance field of 2 Hz above the acropolis and in particular over the Cathedral.

The vibrations from the basement of the church built over the temple are good for relaxing and meditation promoting. It has a frequency of 8Hz with some harmonic frequencies in multiples from 8hz up to 32Hz (i.e. frequencies tuned to the vibration of the planet Earth).

This same "pulsing" sound was also bought into the visible range using the Variable Resonance Imaging Camera. This was captured in the area above the so-called “navel” of the Acropolis, deeply immersed in the outcrop rock hill on which the pagan temple was built. Part of this rock still protrudes to the north of church built below the temple blocks. This rock works as a transducer for the underground vibrations transmitting them perfectly inside the Cathedral of Alatri. It is interesting to note these pulsing vibrations are not transmitted to the blocks inside the original pagan temple, now the church basement. The image below shows the blocks of the ancient temple to the Variable Resonance Imaging Camera appear black, indicating the lack of vibration, as opposed to the underlying rock. This is due to the fact that the blocks are fitted together, but without cement. This fact dampens the vibrations from underground and confirms the seismic character of this building that still stands after thousands of years and many earthquakes.

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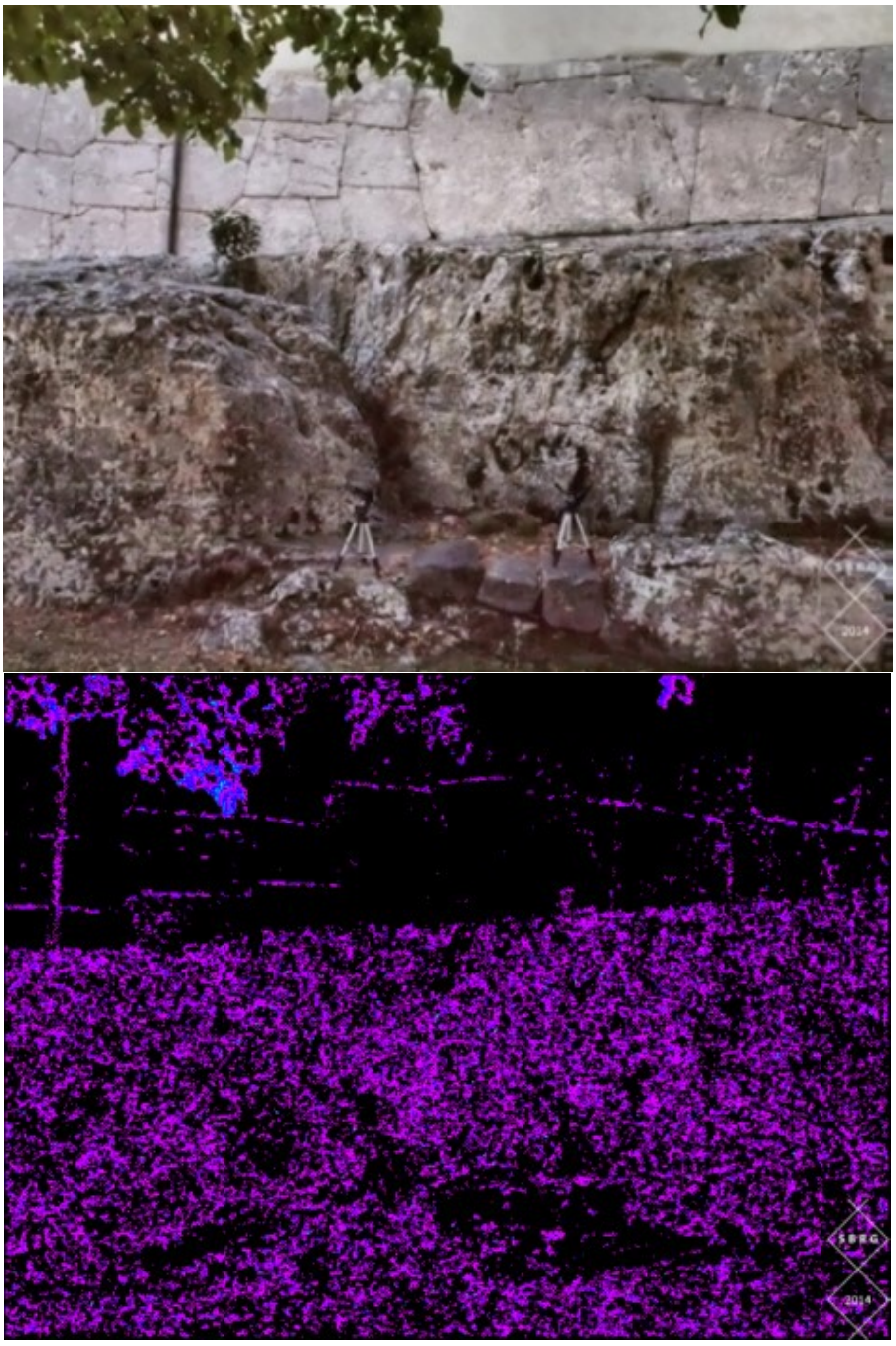

Figure 11 Image of the original pagan temple blocks (without cement) positioned to the north of the Acropolis (above) and the same image shot by the Resonance Variable Camera (below). The Cyclopean blocks appear black in colour because they do not transmit the vibrations coming from below the ground.

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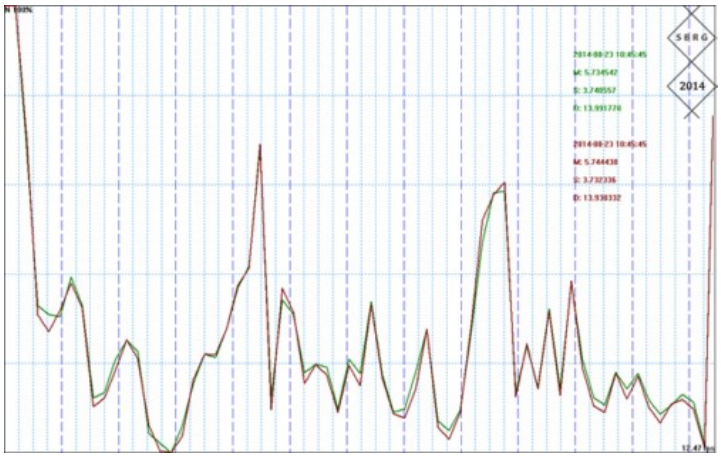

Figure 12 The graph (0.1-12Hz) of the low frequency (subsonic) peaks detectable in the navel area of the Acropolis.

Figure 13 The Minor Gate of the Acropolis (above) and the sequence of images at the Minor Gate as taken by the Resonance Variable Camera (below). Clearly visible is the vibration found in this place, albeit to a lesser degree than at the “navel” of the Acropolis. Inside the gate the outline of a person can be seen sitting on the steps, they appear in a different colour as they are vibrating at a different frequency.

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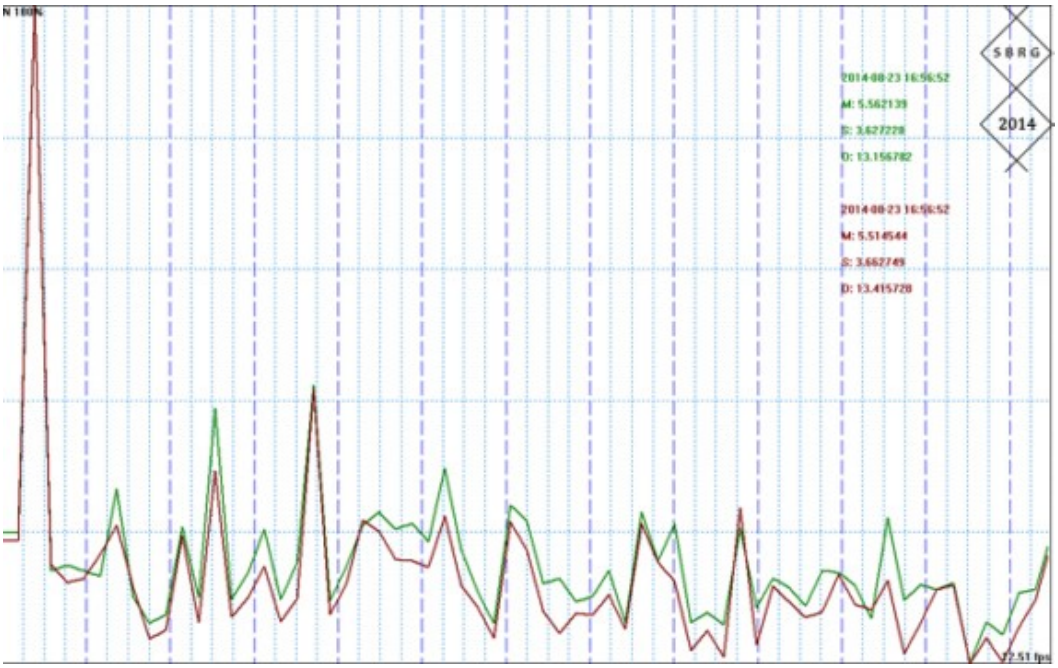

Figure 14 The graph of the frequencies present at the Minor Gate which are slightly different to those found at the navel of the acropolis.

From what we have seen, these subsonic vibrations do not create a problem for the recipient. Rather, as with other sacred places, it can be assumed their existence is precisely the reason why the Acropolis and the temple were built in that location as opposed to the neighbouring hills. Anyone who undertakes prayer or meditation inside the church has the potential to feel the effect of these subsonic vibrations, whose influence could ultimately lead to altered states of consciousness, or mystical experiences (usually only experienced after many years of training as with Buddhist monks).

To test this claim, we proceeded to test the depth of meditation that can be reached in a short timeframe with a small number of volunteers (six people), seated on the so-called "navel" of the Acropolis (or inside the church), the outcrop rock in the centre of the acropolis. Part of this rock protrudes from the walls of the church basement, and part is located deep within the hillside, as such it superbly transmits the underground subsonic vibrations.

The depth of relaxation reached by the volunteers was also examined using the TRV camera. This was carried out by measuring the subtle body vibration, specifically the vestibular organ (inner ear), which regulates balance and spatial awareness. If the subject in question is stressed some imperceptible body vibrations increase and can be immediately detected by the TRV camcorder. However, if the subject is relaxed its vibrations diminish to become imperceptible even to the equipment. This last state is reached only in a state of deep meditation or in the state of vigil prayer.

In the first image below, a volunteer sits on the rock. The camera framing the subject immediately notes that they are vibrating at a higher frequency than the rock (according to the scale of reference, the blue-green colour is

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indicative of a frequency of 5-6Hz). Of note is that this volunteer was already in a state of relaxation and low stress having spent several hours on the acropolis.

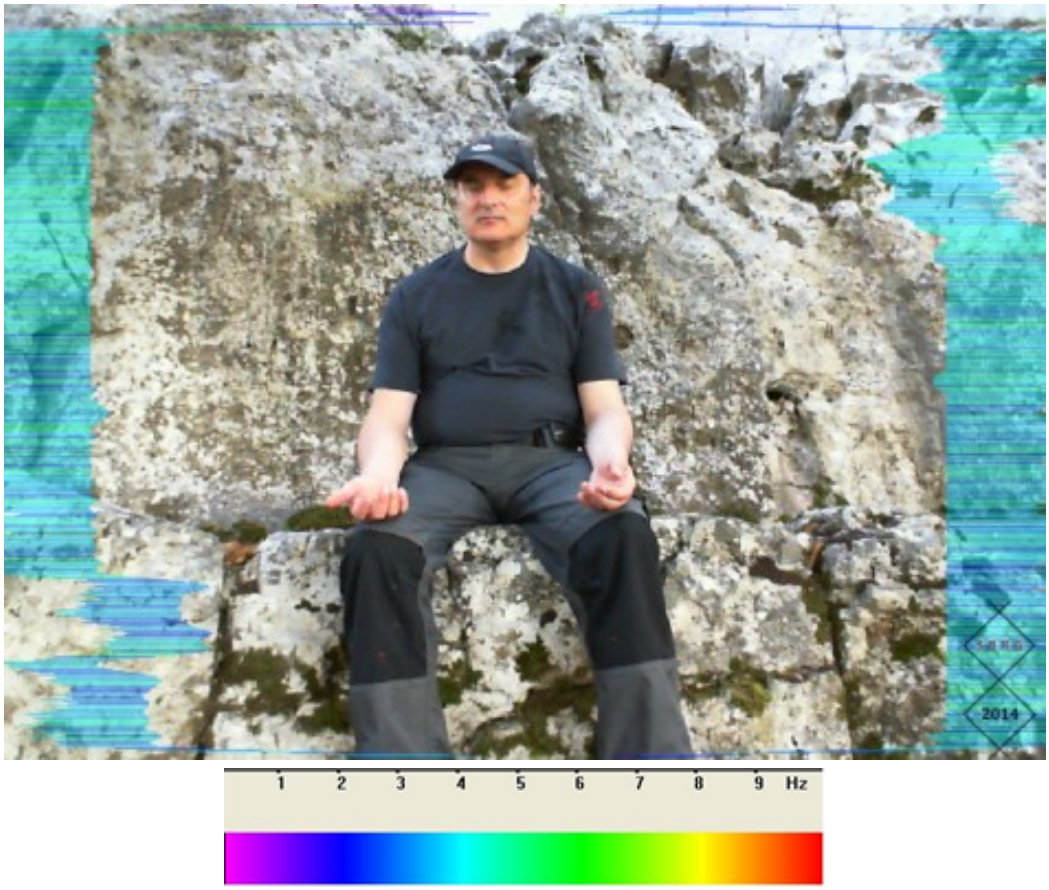

Figure 15 The subject under examination starts from a state of relaxation having spent several hours on the acropolis.

After few minutes of meditation, the subject begins to vibrate at a slower frequency indicating a deep relaxed state. After a few minutes of concentration sitting on the rock, they vibrate at such a low frequency (less than one Hz) it becomes difficult for the camera to distinguish them from the rock. This is known as entrainment, a phenomenon in which two or more independent rhythmic processes synchronize with each other [17].

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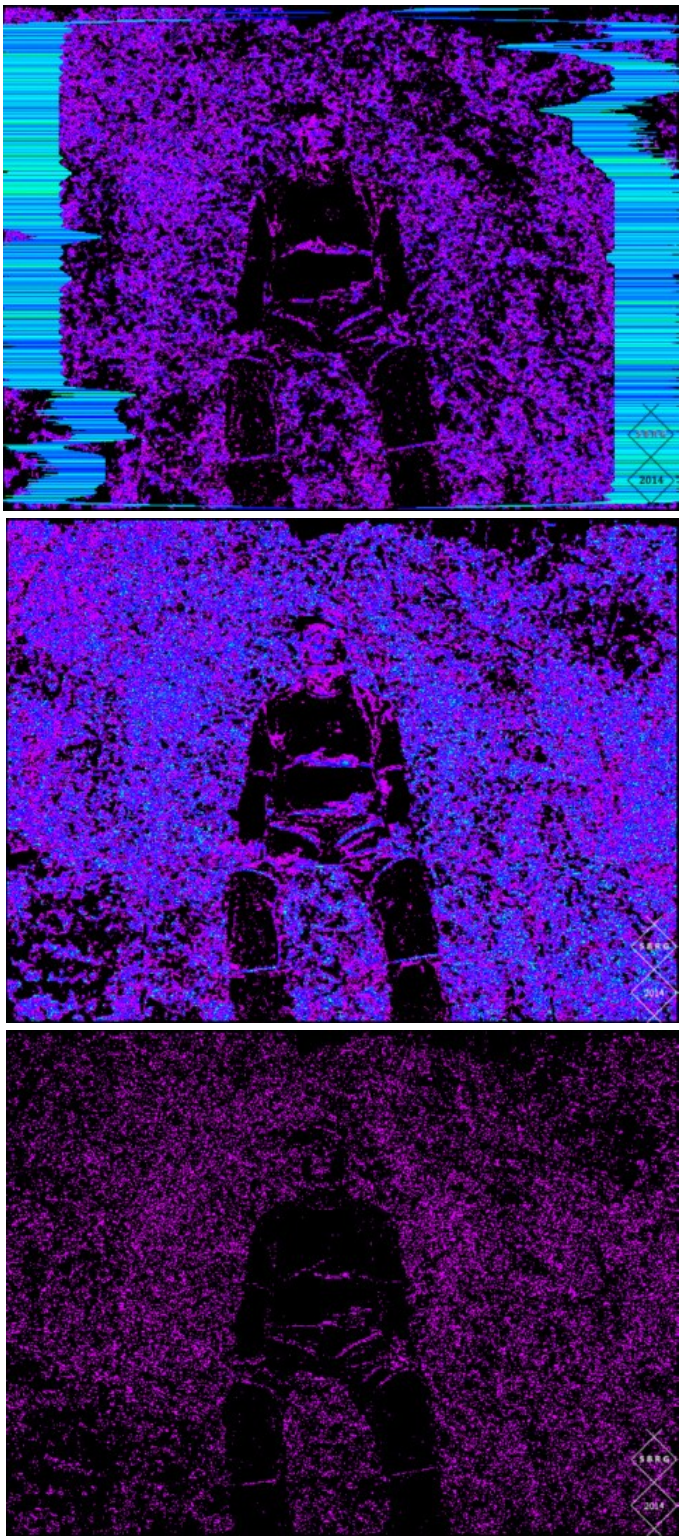

Figure 16 After a few minutes, the volunteer's vibrational frequency is so low, it becomes indistinguishable from the rock when viewed through the Variable Resonance Imaging Camera.

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It is an experience that works best in trained subjects in prayer or meditation, but it is also visible in younger subjects as occurred to a 9 year old volunteer. In this last subject a state of pronounced relaxation is reached, which surely acts as an anti-stress.

Figure 17 The rock situated in the Acropolis navel, leads volunteer subjects into a coherent state during meditation. The frequency average varies from person to person and is dependent on the length of time they are exposed to the vibration.

The Imaging Resonance Camera is an extraordinary device because it can provide an indication of the mental state of the subject by monitoring the vibrations from the vestibular apparatus, which is directly influenced by the mental state of the person in question. But the use of the TRV technique has also shown how ancient places revered as sacred have an influence on the state of consciousness of those visiting them for prayer or meditation.

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Figure 18 The image of Alatri Cathedral viewed from the inside (above). The researcher of SB Research Group with the TRV system at work is in the foreground. The image of the underground vibrations (red colour) taken with the TRV camera that affects the church (below). This image is the composite of many shots.

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Figure 19 The entire church and the people sitting inside it seem to get into a state of harmonic resonance (somewhere between 0.1 Hz and 3 Hz) when concentrated in meditation or prayer.

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Figure 20 Inside the church all psycho-physiological data issued by the TRV software seems to confirm that states of aggression and stress are remarkably low. The volunteer subjects in meditation can easily achieve a deep state of concentration reaching a consistent theta wave state without interruption.

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Figure 21 Outside the church on the opposite side of the Acropolis, the physicochemical parameters measured from the TRV equipment appear different, and the relaxing effect of the place seems more nuanced compared to inside the perimeter of the temple.

We also examined the surrounding areas of Alatri to detect if similar vibrations are present elsewhere. There is something in the nearby hills, but not so strong as in Alatri acropolis, as it is only perceptible using instruments rather than physically. Low frequencies are non-directional and are not absorbed much by the soil, therefore they can travel long distances. But the low volume sounds found on the slope facing of Alatri's Montelungo hill, are not felt in the same way as those on the top of Alatri Acropolis. This may

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explain why the ancients chose the hill of Alatri to build their temple even when they had a large number of hills with similar characteristics to choose from.

5 Discussion

As in other sacred sites studied by SBRG there is something special in Alatri which convinced the builder to build the acropolis just there. In particular, at the level of what historians refer to as the "navel" of the acropolis located on the north side of the church built over the ancient temple [1].

Figure 22 The main façade of the cathedral-basilica of St. Paul Apostle (side East) built over the ancient temple.

There is a significant prevalence of low frequencies here as shown in the graph of data recorded at midnight on the North side of the ancient temple, (which is now a Catholic church). This anomaly is even more evident when it is compared with files recorded on the same night at the East side of the Acropolis.

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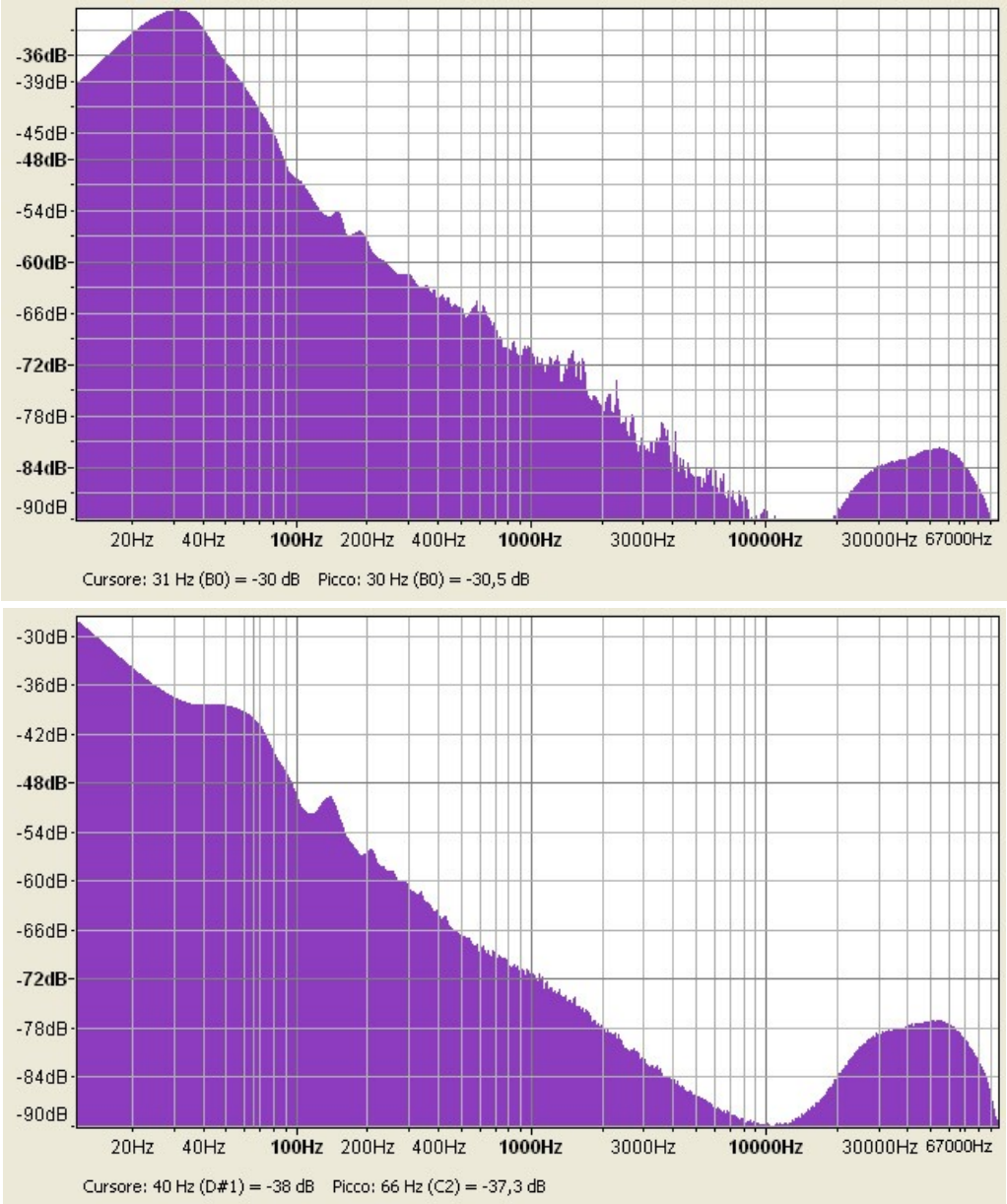

Figure 23 Graph collected at the "navel" of the hill which has a frequency of around 30 -31Hz (above) for comparison with that found along the East side (below). The peak of ultrasounds at the end of the curve is only an artificial aspect of the ultrasensitive microphones.

As it can be seen from figure 23, the second graph is without the peak of low frequencies found at the centre of the acropolis of around 30 - 31Hz. The sound seems to be concentrated solely in the navel of the acropolis and fades into nothing when moving away from the navel. It is likely the vibrations are coming from the geological faults (see Figure 25) running very close to Alatri, with their vibrations channelled via some strange phenomenon to the top of the hill.

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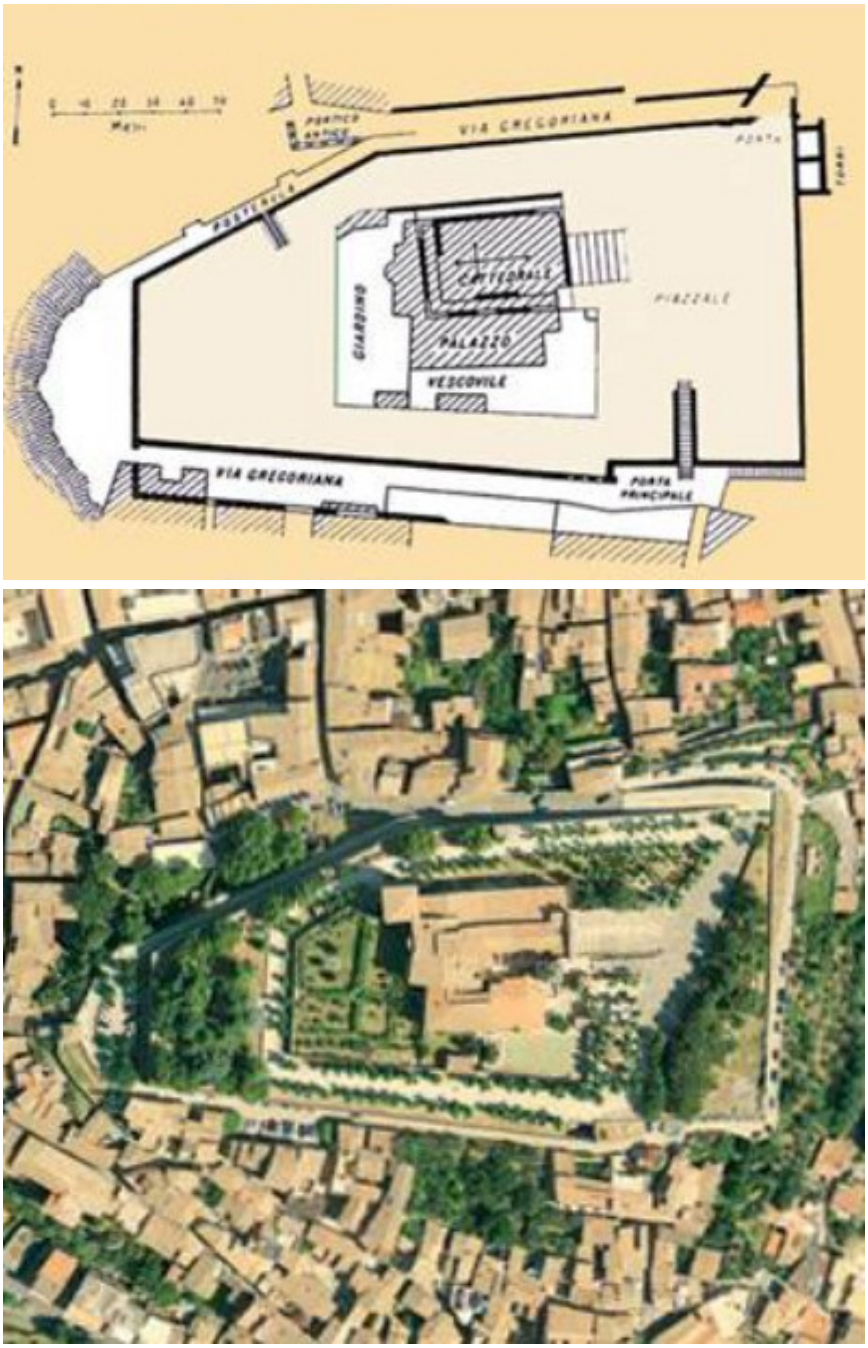

Figure 24 The map of the acropolis (above) and its aerial view (below). The upper side corresponds to the North (images from the archive of O.Tofani).

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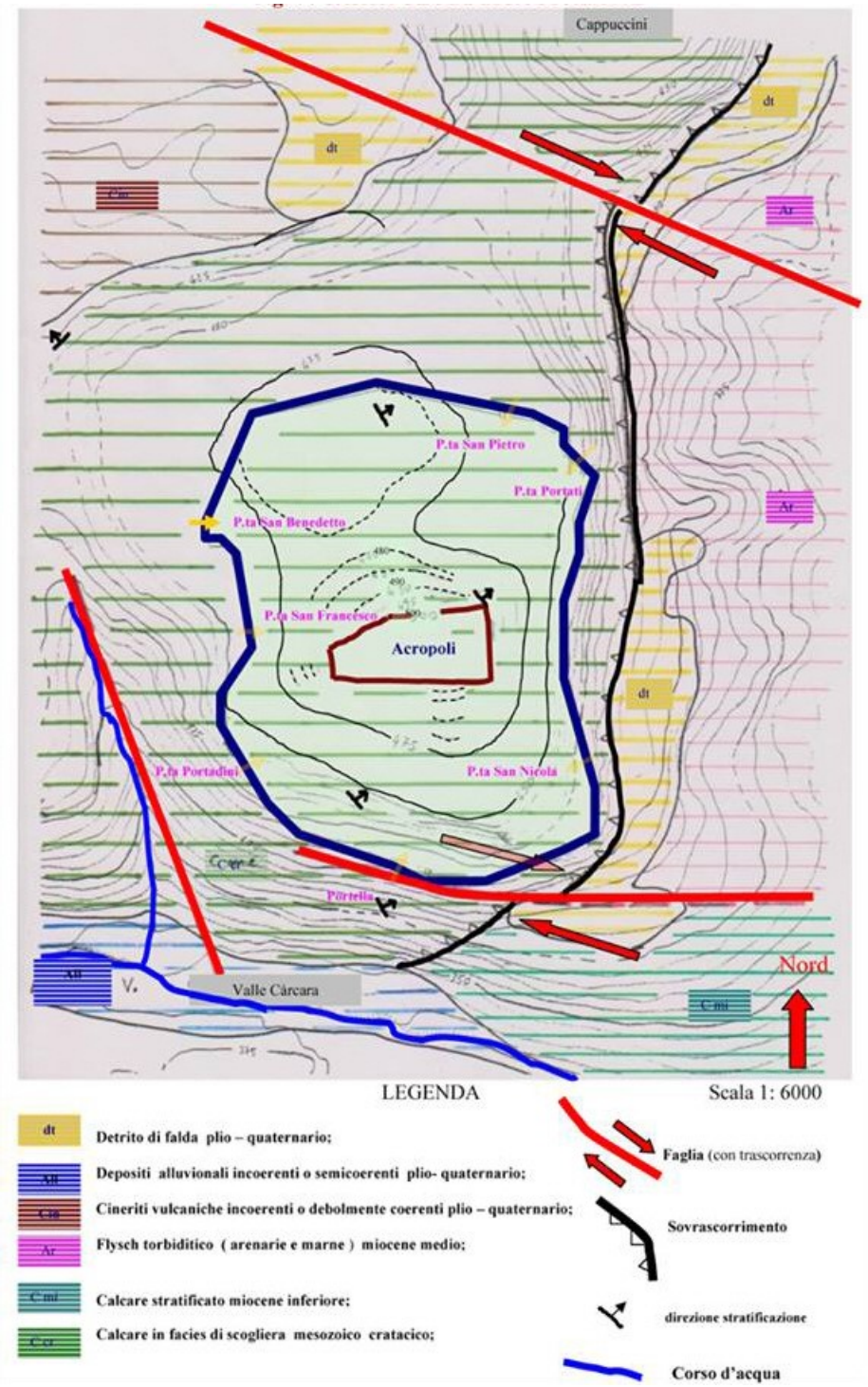

Figure 24 The geological map of the area of Alatri shows a significant movement of the geological faults (in red colour) which may explain the vibrations that are picked up on the Acropolis of Alatri (in brown colour). The arrows placed close to the faults show the direction of the tectonic movements likely producing the vibrations recorded on the top of the acropolis (map made by geologist Dr. Rocco Torre).

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About the concept of “entrainment” we observed in volunteers placed on the navel of the acropolis, it describes the interaction and consequent synchronization of two or more rhythmic processes or oscillators. Entrainment as a concept has a considerable history - it was first identified by the Dutch physicist Christiaan Huygens in 1665 and has been applied widely in mathematics and in the physical, biological, and social sciences. It is a process that manifests in many ways, some of which involve human agency or cognition. Strangely though, it has had relatively little impact to date in studies of music, where it might be thought particularly relevant, and is only beginning to be seriously considered within ethnomusicology [17]. We believe that this concept could have a particularly significant impact if applied to archaeoacoustic research because it offers a new approach to understanding low vibrations making and sound perception as an integrated, embodied and interactive process, and can therefore shed light on many issues central to archaeoacoustic thought. Entrainment may be central to an ethnomusicological orientation for which performance and listening are the focus of interest. Such a development is likely to be more productive if researchers share an understanding of what the concept implies [17].

We also worked with volunteers who underwent examination by electroencephalography (EEG) while listening to tones similar to the resonant sounds found at some Neolithic structures in Europe (England, Ireland, Italy, Malta). Research was carried out in collaboration with the Head and Neck Department and the Clinical Neurophysiological Unit at the University of Trieste (Italy) to assess the effects of resonance phenomena on the human body [9]. All of our volunteers were subjected to a "comfortable" volume of sound whilst in the absorbing sound room. This is used for audiometric tests at the Otorhinolaryngology Clinic and has been modified with suitable software and hardware. Skilled technicians examined the EEGs to verify the data collected. They found there was a prevalence of frontal areas or occipital (posterior) areas with no predominance of one cerebral hemisphere (left of right) over the other during playing. Each volunteer had a different sensitivity to tones without one tone prevailing [9]. But this method is less practical than TRV camera for analysing the emotional state of the volunteer in open spaces with possible external interferences. So we decided to follow this last method respect EEG as the best way for researching like in other researches we did in other sites [12] and the results look totally satisfying.

At the end we also could say that the Minor Door which is perfectly oriented along the equinoxes is a great place to record the vibrations without being disturbed by noise from the open field, as it offers protection that has enabled some recordings to be almost noise free.

6 CONCLUSION

The continued exposure to the vibrations inside Alatri acropolis has a significant effect on the psyche of those who came for prayer and meditation, facilitating access into a mystical state. Even though they did not have the same equipment we have today, ancient people were aware of the conditions

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required to achieve such a mystical state, perhaps by simply sensing that in that place they were closer to God. Maybe this was an ancient wisdom where more attention was given to the care of the spirit than in present times. Archaeaoacoustics is an interesting method of analysing ancient sites to re-discover a forgotten technique that affects the emotional sphere of human consciousness. Alatri acropolis still functions as a place where altered conscience can be achieved when the people are in meditation or during prayers. The objective findings observed by the TRV instrumentation represent something already detached from subjective perception of the people considered and variously reported with subjective sensations also by the protagonists of our previous research.

Ultimately the devices used, TRV system and digital recorders, confirm that a "mystical" state can be reached after a few minutes by those who are subjected to the vibration phenomenon inside the acropolis.

When looked at alongside research on the effect of acoustics on the human body, we can say archaeoacoustics is a method of analysing ancient sites from another point of view. Indeed, its study presents a chance to recover “ancient knowledge” that affects the emotional sphere of human consciousness, as well as to broaden our understanding of the ancient world.

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COMPETING INTERESTS STATEMENT

No competing interests, which may influence the results of this research, are present for both authors.

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