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Archaeoacoustic Analysis of Tarxien Temples in Malta

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Abstract

The Tarxien Temples in Malta were analysed from an archaeoacoustic point of view. As there is no roof present, it was not possible to find the resonance properties of the various chambers. This investigation however, discovered an interesting low vibration originating from below the ground. The most likely explanation of its origin is due to the movement of underground water through geological faults. This vibration appears to be transmitted through the megaliths, some of which have concavities or carved holes. Previous archaeological interpretation, has suggested these were likely to have been used to support the foundations of some sort of barrier or door, but without any supporting evidence. Using archaeoacoustic methods a new interpretation of these architectonic particularities is put forward, acting as some type of forerunner to speakers..

Keywords: Tarxien Temples, Malta, stone circle, resonance, brain activity, megalithic architecture

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1. Introduction

Archaeo-acoustics or archaeoacoustics is a complementary discipline of archaeology which may help to 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 and for what purpose.

SBRG[4] research group has over a number of years, demonstrated a relationship between mechanical vibrations present at some Neolithic temples, with resonance phenomenon and brain activity (Debertolis, Tirelli & Monti, 2014; Debertolis & Bisconti, 2014; Debertolis, Coimbra & Eneix, 2015; Debertolis & Zivic, 2015, Debertolis & Gullà, 2016).

SBRG research group has also proposed that at Roman temples and thermal baths the architects of that period utilised natural vibrations to increase the wellbeing or ritualistic effect. Natural low vibrations with an absence of high pressure can have a positive influence on human wellbeing, with some people perceiving very low-frequency sounds as a sensation rather than a sound (Debertolis & Bisconti, 2013).

Infrasound may also cause feelings of awe or fear in humans, given it is not consciously perceived, it could give the impression that odd or supernatural events are taking place (Tandy & Lawrence, 1998). In contrast, severe, artificial or extreme sounds imposed on the sonic environment could have a profoundly destabilizing effect on the individual, indeed infrasound has been used in the area of acoustic weapons (Debertolis & Bisconti, 2013).

[4] SB Research Group (SBRG) is an international and interdisciplinary project team of researchers from Italy, Finland, U.K., Croatia, Serbia and Macedonia, investigating on archaeoacoustics of ancient sites and temples in Europe and Asia.

So it is possible to hypothesize that where a lot of natural low vibrations are concentrated, ancient populations considered these sites to be in some way significant or "sacred" (Debertolis & Bisconti, 2013).

Starting from the premise that past ages were not devoid of noise or spent in silence, the highest expression of culture was through the arts; the human voice used in song, accompanied by vibrations from musical instruments being one such example. Indeed, natural sound phenomena were used in several civilizations to create impressive rites, with some ancient structures designed to directly influence the mind towards a particular state of consciousness through the vibrations they produced (Jahn, Devereux & Ibison, 1996; Watson, 2006; Devereux, Krippner, Tartz & Fish, 2007; Cook, Pajot & Leuchter, 2008; Debertolis & Bisconti, 2014; Debertolis & Gullà, 2015).

Through archaeoacoustical analysis, it has been possible to demonstrate there was some knowledge of acoustic phenomena in the past, which could be used to enhance ancient rituals (Debertolis & Savolainen, 2012; Debertolis & Bisconti, 2013a; Debertolis & Bisconti, 2013b; Debertolis, Mizdrak, Savolainen, 2013; Debertolis, Tirelli & Monti, 2014; Debertolis & Bisconti, 2014; Debertolis, Tentov, Nikolić, Marianović, Savolainen & Earl, 2014; Debertolis, Coimbra & Eneix, 2015, Debertolis & Zivić, 2015; Debertolis & Gullà 2016a, 2016b, 2016c).

With the authorization from Heritage Malta, acoustic analysis was undertaken at a number of Neolithic sites on Malta and Gozo, to gain insight into some historical mysteries. SBRG research group previously published results from the Hal Saflieni Hypogeum, Malta (Debertolis, Coimbra & Eneix, 2015).

In this paper, the results of the investigation on Tarxien Temples, a complex of Neolithic temples located near Hal Saflieni Hypogeum, a subterranean structure are discussed. It has been suggested both these sites, were once part of a larger complex.

The Tarxien Complex

The Neolithic temples of Tarxien are located on the north side of the island in the town of Tarxien, surrounded by houses. As a result, taking high-level recordings was much more challenging than it had been inside the Hal Saflieni hypogeum. These temples were brought to light by the Maltese archaeologist T. Zammit in 1915 after some local farmers had complained that when ploughing the field above the temples, their plough was ruined by large stone blocks. These temples were further excavated in 1954 by English archaeologist J.D. Evans and four years later by D. Trump who discovered the re-use of them in the times of the Roman Empire as a cellar (Pace, 2006).

The Tarxien Temple site consists of a complex of four megalithic structures built during three distinct time periods between approximately 3600 BC and 700 BC. Archaeologists believed these were the oldest freestanding structures on Earth, but the larger complex of Gebekli Tepe, recently unearthed in Turkey has since taken this place. The Neolithic complex in Malta was initially built between 3,600 and 3,000 BC as a sacred place, but at the beginning of the Bronze Age (2400-1500 BC) the original temples were reused as storage for funeral urns. This indicates that the original population was replaced by newcomers with different social customs.

Fig. 1: Some temples are totally submerged in the soil, similar to the more ancient site of Gobekli Tepe, Turkey.

During reconstruction work in the 1950s, when damage to any megalith was discovered, reconstruction was carried out using Portland cement, which ran the risk of restoring something untrue to the original. Further, the type of material used when compared to the original coralline limestone megaliths in their uncorrected position, may have been detrimental to the proper acoustical functioning of the old structure. Not forgetting that the concrete reconstruction process may also have damaged the original stone. Unfortunately at the time of the restoration this problem was unknown (Pace, 2006).

Fig. 2: The prehistoric complex surrounded by a densely populated town

Fig. 3: Through the temple gates

The reconstructed parts of the megaliths appear much lighter when compared to the original under infrared photography. In normal photography, these parts appear more visible because they are brighter. The infrared photography also cancels the dark colour due to moulds and lichens present on the surface of the megaliths, preventing the structural element being viewed in its entirety.

Fig. 4: Infrared photographs which differentiates between the original stone (in gray) from the reconstructed concrete (in white, this difference between these two materials is exaggerated through the reflection of sunlight).

The first temple is located on the eastern side and built between 3,600 to 3,200 BC. Unfortunately despite the five apses being clearly visible, only the foundations remain.

The South Temple is the most highly decorated with megalithic constructions that contain the lower part of a colossal statue of a female figure and the East Temple with its walls of stone slabs and well shaped 'oracle' holes both built between 3,150 and 2,500 BC. The Central Temple has six apses arranged on one floor and contains evidence of a cover arcs.

Fig. 5: The same architectural element taken using two different techniques. Above: taken with an Olympus E- 5 digital cameras with proprietary software to enhance contrast. Below: taken with a modified Canon infrared camera. There is a clear lack of ability to reflect the sun's rays on cement that looks almost white in colour, while the sky is almost completely black

Material and Methods

The SB Research Group Standard for archaeoacoustics (SBSA) (Debertolis, Mizdrak, Savolainen, 2013) that has been tested at several archaeological sites throughout Europe and Asia (Debertolis & Savolainen, 2012; Debertolis & Bisconti, 2013a; Debertolis & Bisconti, 2013b; Debertolis, Mizdrak, Savolainen, 2013; Debertolis & Bisconti, 2014; Debertolis, Tentov, Nikolić, Marianović, Savolainen & Earl, 2014; Debertolis, Coimbra & Eneix, 2015; Debertolis & Gullà, 2016a,b,c) was used in this study. Because archaeological sites can sometimes be influenced by electro-magnetic pollution, devices to avoid anomalous results were used.

The equipment consisted of dynamic high-end recorders extending from the ultrasound to the infrasound range with a maximum sampling rate of 192KHz (Tascam DR-680) or sampling rate of 96KHz (Tascam DR-100 and Zoom H4N equipment). Use of gain control in recording devises is very delicate. In quiet places, maximum gain for recording is used. In more noisy environments gain is determined with 0,775V/0dB AES/EBU standard. The microphones used have a wide dynamic range and a flat response at different frequencies (Sennheiser MKH 3020, frequency response of 10Hz - 50.000Hz) with shielded cables (Mogami Gold Edition XLR) and gold-plated connectors.

Fig. 6: The position of the recording equipment & microphones

If a particular archaeological site has any acoustic or electromagnetic phenomenon either induced or natural, it is possible to identify them using electromagnetic sensors, these form part of the SBRG standard. These sensors were made by Demiurg; however it is possible for anyone with a practical knowledge of electronics to make.

Essentially, they consist of two small condensers and one copper coil, it's the diameter of the coil that modifies the devices sensitivity. The frequency response is linear from 5Hz to 99.5 KHz which covers any frequency that could influence the microphones (VLF, Very Low Frequencies and LF, Low Frequencies radio waves). Such sensors can also detect natural emissions that may be present at an archaeological site.

Using this method it is not possible to eliminate sources of interference, but it is possible to identify any source which can affect the recordings as well as those capable of influencing a person's psyche. The process of cleaning recordings is carried out in the audio studio taking the above factors into consideration.

Fig. 7: The sensors with different sensitivity (300Ω) that transform electromagnetic impulses from the environment, into electrical impulses used by the digital recorder.

Pro Tools ver. 9.06 software for Mac was used to analyse the various recorded tracks, Praat version 4.2.1 from the University of Toronto and Audacity open-source program version 2.0.2, both for Windows PC was also used. A spectrum analyzer (Spectran NF-3010 from the German factory Aaronia AG) was used before recording to detect electromagnetic phenomena that could potentially be present and risk influencing the results.

Results

The analysis of the recordings revealed what appears to be a very low frequency coming from below the ground in the 21Hz to 23Hz range. On some occasions, this encroached the (inaudible) infrasound frequency band with a peak of around 18Hz (see Fig.8).

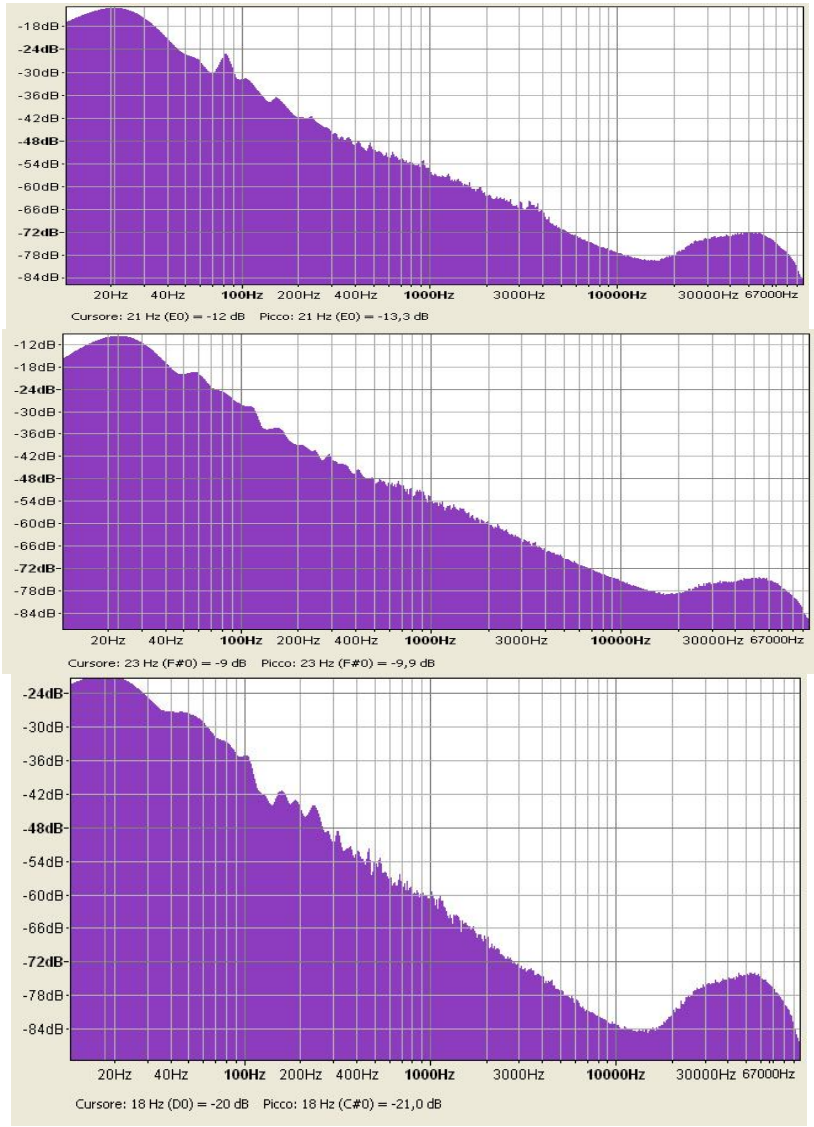

Fig. 8: Three recordings taken at two different locations. There is a large peak with a maximum of 21 - 23Hz in almost all surveys, sometimes extending to 18Hz. No ultrasounds were detected inside Tarxien Temples (the hump at the end of the plot, is an artefact determined by the characteristics of ultra-sensitive microphones)

The most likely explanation for the source of these inaudible vibrations, are from ground water travelling through a nearby geological fault. Indeed, Malta is an area rich in such faults and close to an area where the tectonic plates meet such as that between the African and Eurasian land masses close to its archipelago (see Fig.9).

Serpelloni highlighted in 2007 the strong activity of this geological fault by GPS stations (see Fig.10).

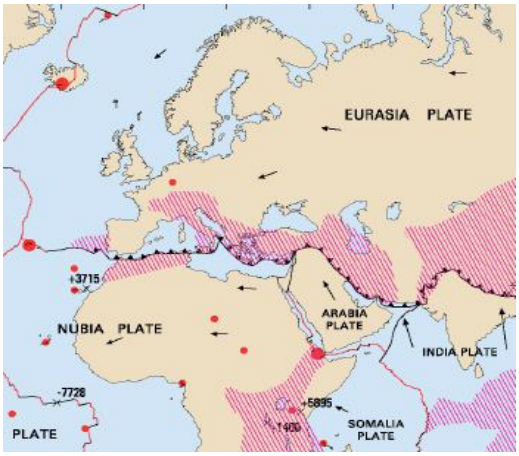

Fig. 9: The line of contact between Nubia and Eurasia plates

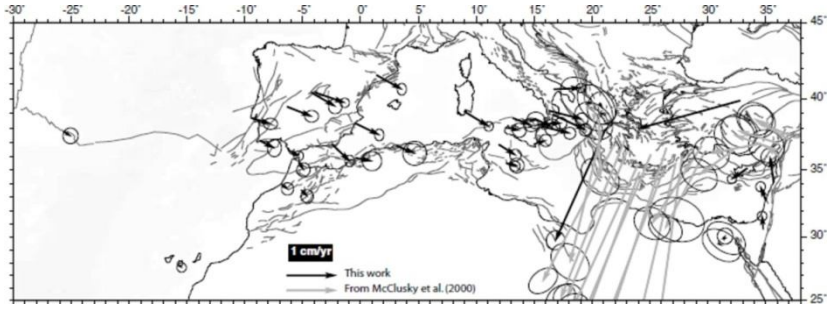

Fig. 10: Velocities of GPS stations along the Nubia-Eurasia plate boundary (from Serpelloni E. et al., Geophys. J. Int. 2007)

As verified in previous research on ancient sites in Europe (Bosnia-Herzegovina, Serbia, South England, Portugal, Alatri in Italy, and Sogmatar in Turkey), this type of frequency at a low volume, can have a positive effect on brain activity, with this effect particularly evident in those people who practice meditation or prayer.

Measurements were taken in an attempt to verify the presence of a resonance phenomenon within the complex's two temples considered to be the best condition for this purpose. Various musical instruments were used, from primitive shamanic drum to percussion bells, but without success. Unfortunately, the structure is too destroyed and although once believed to have been covered by a dome roof, nothing of this remains today.

The recordingd in the nearby hypogeum of Hal Saflieni (situated a short distance from the temples of Taxien), were free from these same vibrations (Debertolis, Coimbra & Eneix, 2015). The very low volume at the start of the sound line should not deceive as the recording was made at a lower volume. Regardless of the volume, the result does not change because the peak of 21 - 23Hz that was detected in the Temples of Tarxiem, is missing here (see Fig. 11).

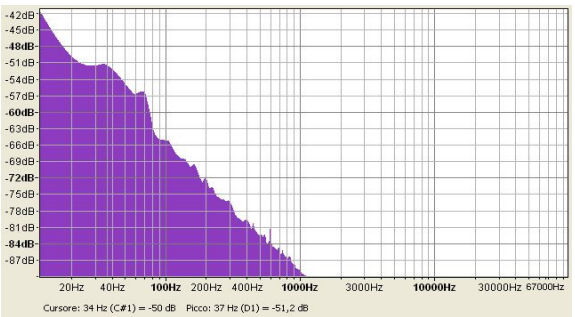

Fig. 11: The recording taken in Hal Saflieni Hypogeum located close to the Tarxien Temples. It appears to be without any vibrations.

Discussion

SBRG research group performed measurements on two of the four temples, with similar results. Over the following days, the same analysis was performed in Hal Saflieni Hypogeum, located a few hundred meters from Tarxien Temples. Apart from a strong resonance created by the interesting architectural design, the same frequency was not found (Debertolis, Coimbra & Eneix, 2015).

For this reason it was concluded that this underground frequency is present only in the location where the surface temples were built. With the underground vibrations, it was observed that some megaliths appear to act as vibrational transducers with some inner concavities or holes seeming to project and focus these vibrations.

Fig. 12: A sensitive hand can discern the low-frequency vibrations.

The holes found in the megaliths are very deep and considered to have been used to support the foundations of some sort of barrier or door. However, there is no evidence to support this hypothesis, for example at Ggantija Temple in Gozo island, these holes do not run the entire length of the megaliths, which would be logical if they were designed to offer such support for a door (see Fig. 14).

The interesting phenomena they exhibit offers an insight into a lost ancient technology previously only detected through the sensitivity a hand placed in front of them. In this modern era however, sophisticated equipment can be used to discover their properties.

Closer examination in respect of the holes direction, suggests that they concentrate mechanical sound vibrations, in a similar way that modern day audio speakers function. The mechanism seems to provide an intriguing interpretation of this archaeological site but requires further in-depth analysis, a new inspection to re-check the data is planned in the near future.

Fig. 13: Graphical extrapolation of the sound from the megaliths

Other Maltese temples on Gozo, namely Ggantija Temples and Xaghra Circle were also examined. Xaghra Circle featured a strong underground vibration of around 25-34Hz (Debertolis & Earl, 2014). This is an extremely powerful vibration, more or less comparable to what was found in Tarxien Temples, but with a slightly longer high frequency range and also featuring some oscillation.

The most plausible source of these vibrations is that they originate from the movement of groundwater passing through geological faults (Danskin, 1998).

In contrast, at Ggantija Temples (which are located close to the Xaghra Circle), no such vibrations were found. The same was true for the holes at the Ggantija megaliths, which was in contrast to the vibrations found at Tarxien Temples. There may be a possible explanation as to why Ggantija features an absence of vibrations. If an earthquake occurred at any time throughout the 6,000 year period the site has existed, this could clearly alter the course of any underground water flow and consequently any such vibrations they emit.

Fig. 14: The holes carved in a megalith at Ggantija, where no underground vibrations were found.

Conclusion

Archaeoacoustics provides a way to offer new interpretations on anthropologic questions pertaining to ancient architecture and populations. The vibrations discovered at Tarxien are close to the rhythm of brain wave frequencies. When people are engaged in prayer or a meditative state, this can lend to a sense of exaltation and mysticism.

After six years of research at a number of ancient sites, we propose that ancient people through empirical observation, had an understanding that some locations had particular proprieties that could affect the mind (Debertolis & Savolainen, 2012; Debertolis & Bisconti, 2013a; Debertolis & Bisconti, 2013b; Debertolis, Mizdrak, Savolainen, 2013; Debertolis, Tirelli & Monti, 2014; Debertolis & Bisconti, 2014; Debertolis, Tentov, Nikolić, Marianović, Savolainen & Earl, 2014; Debertolis, Coimbra & Eneix, 2015, Debertolis & Zivic, 2015, Debertolis & Gullà, 2016a,b,c).

This is the reason why temples were built in those particular locations, a lost knowledge being rediscovered with the help of advanced devices. How was it that nearly 2,000 years ago the ancient Maltese population were able to find these locations without the measuring devices of today? It is known that the ancient Romans derived their knowledge of this field from the more ancient Etruscan civilization. In particular Titus Livius wrote in his book "*Hystory of Rome*" about the Roman architects of the time, a particular category of soothsayers, called *àuguri* (augurs) who had the ability to detect such vibrations using various methods of divination. Their skills were used to find the optimal location for a military camp, public building or spa, with great care taken to avoid any potential negative impact on health.

It could be possible such knowledge was known by populations not so too distant geographically; perhaps in the case of Malta this knowledge may have been practiced. Equally, it is possible that the two civilizations developed these methods separately, but it will be necessary in the coming months to further survey the archaeological.

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