SMALL HOLES OF WONDER

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ABSTRACT

While exploring different paths to history, in search of the known but elusive proofs of music making, we have encountered specific types of ceremonial rocks that 'speak' of their potential and extensive use. Furthermore, the placement of these rocks seems to have answered a magical call, in well-chosen open auditoriums for who knows what. The vast territory, in Portugal, where a large number of these can be found, has an extended gallery of rock art and megalithic assemblages. In order to study the special 'little hollows rocks', or '*rochas com covinhas*', we envisaged a systematic methodology for measuring and analysing, not only regarding an objective identification but also, given their disperse locations, for an intentional comparison of results. Besides the use of the measuring-grid created for this purpose, two procedures were proven to be necessary for the full coverage of this survey: 1) Acoustical analysis of the sound produced in the flat surfaces and in the hollows, and comparison between the signals from different depths and shapes; 2) Observation, in the area, of the amplitude and repercussion of the formulated sound, recurring to readings in strategic positions surrounding the rocks. By attesting the musical exploitation of these pre-historical objects, we are trying to contribute to the understanding of how important was sound and its abstract organisation in the development of the human race. In our research, we are bridging organology, acoustics and archaeology.

1. INTRODUCTION

So much has been wondered about inscriptions on ancient rocks – so many wonders are still to be uncovered. The detection of little holes or cup-marks ('*covinhas*') in some of the rocks situated in pre-historical settings, although centuries old, was particularly brought to closer attention from the early 20th-century onwards, with the development of archaeological, anthropological and ethnological studies carried out in Portugal. The spotlight shone again, here and there, in the subsequent years, resulting in several publications which deal, for the major part, with specific monuments and not exclusively with the rocks that have cup-marks. Then and now, the enigma remains.

Nevertheless, through our work we are trying to find some answers based on scientific parameters: the sound and vibrating properties of the rocks and its propagation in the immediate and remote areas. We are considering rites, stories or legends related to 'sacred' monuments or sites as not more than indicators of possible ancient practices – any location that is important strategically or which offers special characteristics, or any extraordinary rock shape or set of rocks with unusual features, are unsurprisingly associated with 'paranormal' attributes, and as such have been used or even enhanced from immemorial times; more evidently so when we observe human interference or strategy, as in cromlechs. In our work, we are analysing the production and transmission of sound of these special rocks, hoping that this study may contribute to further research and knowledge regarding the human development and the origins of music.

2. CONTEXT

2.1 Human or Nature?

Not all cup-marks have been made through the use of an incisive object with which the rock is struck by a human hand, nor did all occur naturally. And the borderline is not 'clear cut';

it is not easy to define plainly which are which. We do not assume that all marks, with a somewhat round and concave shape, have been made by a human either for 'a purpose' (as in rock-art) or by repeated percussion. Sometimes the first has been implied by naming the hollows as 'insculptures', but the observation of a number of these rocks clearly show no evidence of patterns, geometrical conception, or any 'thought' behind the placement of the marks. On the other hand, we have noticed that all the rocks with resonating properties, situated in an archaeological location, have these marks – moreover, in the context of a group or rocks, the only one whose sound is noticeable is the one with marks.

We have also observed rocks with hollows which have no significant sound quality when struck. The indenting could be from human practices [1], but in most cases there are clear features that indicate the holes being created 'naturally'. The generating causes can be something as simple as a continuous falling drop or a channel from rain or condensed water – there could have been a branch from a tree, another rock, or simply the water flow. Many times the causes are no longer 'there', but once there had been a beginning of the hole, the subsequent holding of the water would most probably increase the depth of the hole [2]. Most of these rocks are not homogeneous, and some components are more reactive to water than others, thus provoking a higher degree of erosion in some locations of the rock. Most of these have been found on the top of a horizontal platform, but they can also be found on the bottom (upside down). A good example of a naturally 'sculpted' rock was extensively studied by geologist Carlos Neto de Carvalho [3], a rock situated inside the early fortification of the *inselberg* Monsanto with more legends than its 14 hollows – these, however, are of a rather larger size than the ones we have been working with.

Also important to note is the practice of cutting blocks of stone by first making holes to insert the wedges, a practice still used to-day, but which, in ancient times, was performed in 'historical sites'. These appear in all types of places and surfaces, mostly strategically following the vein of the rock. Sometimes the procedure failed, and the holes were simply left there, meaningless, and without any special sound production besides the hard beating it suffered while it resisted the human effort to split it.

2.2 Musical connections

A considerable work has been carried on the subject of music making on the most remote of human times, and namely stones and rocks with sound producing characteristics [4]. Included in the major group of lithophones, we deal with the ones identified, especially during the past 60 years, as rock gongs [5]: «natural rock(s) (…) which vibrate with a ringing tone when struck and which also show indisputable evidence of having been used as percussion instruments», the majority of which can be seen in Africa. They usually remain in its original location (*in situ*, as pointed by Washsmann in *Musical instruments through the ages*, in 1961), either as part of a setting of rocks conceived following a human strategy, or naturally placed (so to say, original position, or from detachment of the mother rock, fallen to a stabilised sitting). Nonetheless, the early definition implied rocks with clearly distinct 'rings', potentially identifiable as 'musical notes', hence the name 'gong'.

Accompanying and continuing her late husband's entrepreneurship, Catherine Fagg published what can be considered the most exhaustive list of rock gongs known to date [6]. In this book (p. 81), there is a succinct reference to Portugal: the painted cave in Escoural, from the descriptions by Dams (1985) and Glory (1966) and the 'Pedra dos Mouros' megalith, west of Lisbon. The majority of the existing literature produced in Portugal is from archaeological or ethnographic standpoints and usually deals with the description of particular locations. The specialised work on rocks with cup-marks is sporadic. The largest text on the subject that we had access to was published in 1995 and concentrates on '*rochas com covinhas*' from the upper region of the river Tagus (*Tejo*), in the centre-east of Portugal [7]. Among the various theories related to rocks that show 'small holes', there has not been a complete acoustical study of the sound production and propagation when these rocks are struck. We have encountered different displays, rock formations and results, and it is our intention to cover the geographical area of Portugal and to study these 'objects' through a method that will allow comparability. We would also like to remark that the sound quality of the ones sought for as 'rock gongs' is very different from the drum-like sound of the rocks of our study, which are indefinite and short (dry), a description that leads us to suggest the term rock-drum as a distinct name to identify this type of rocks.

3. STARTING OUT

3.1 The sparkling question

On one of our first visits to the museums in the region of Beira, in August 2009, as part of the project of collecting information on all sound making objects and their representation (Database of Musical Instruments – BDIM), Jeremy Montagu asked about the existence of rock gongs in the area. The answer was a visit to Monte de S. Brás [8] to experiment one of the known rocks that have noticeable cup-marks, more likely human made than from natural causes. The result from our first trial led us to wish

to pursue a large scale comparative study. This rock, in particular, presented a far greater sound quality than all the others, or 'normal' rocks, surrounding it, having in mind that they were probably part of some sort of setting (secular or sacred), now displaced, as ascertained from their present positioning. As we stated before, the sound, however, was not similar to the ones identified as 'rock gongs'. These were distinct resonant knocks, but not sustained nor precise. We then decided to develop a systematic methodology to study these rocks which revealed similar properties.

3.2 Selection of rocks

The starting point was to compile the available information on rocks that had marks, since these could possibly be provoked by percussion. The most obvious were the rocks with hollows, known as '*rochas com covinhas*' already referred to above, especially those noted as being part of an archaeological context, as in cromlechs or settings from a deep-rooted epoch (the rock in S. Brás is an example: although possibly having slid from a former position, as observed by geologist Carlos Carvalho, it is located in an area with a clear pre- or proto-historic occupation, as the remnants of a defence wall testify [9]). A group of four rocks from different locations was selected, purposely varying in elementary features like composition, position (horizontal and vertical), size and neighbouring landscape. In addition, we experienced also with a rock with no historical connection, of smaller dimensions and no marks, but which contains detached layers similar to the ones of the other selected rocks which offered analogous sound properties. With this rock we could advance our study striking with a stone, without fear of damaging the surface, whereas the ones within an historical setting were analysed through the use of a non-invasive method, described below. For those interested in the locations, please contact the Associação Nacional de Instrumentos Musicais, in Portugal.

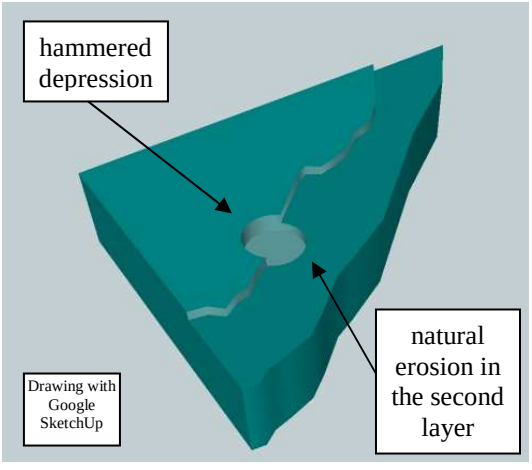
4. METHODOLOGY

Our research, currently in progress, is divided in two parts:
Part I: data retrieval, recording and analysis of the sound produced from rock striking using a non-invasive method; study of the sound propagation, through the air, in the surrounding area.
Part II: analysis of the vibration properties of these rocks (spectra), using an FFT-Analyzer (with direct impact hammer and accelerator); study of the vibration propagation through the soil.
The different stages of work include:
-Preliminary study of the sounding properties of the rock, especially on the marked surface (inside and outside hollows) and selection of different striking points.
-Study of the rock properties and the setting.
-Measurement of the sounding surface/platform and volume of the rock, collecting data on position, direction and inclination.
-Placement of a fixed grid (squares 50mmx50mm) coinciding with the North/West alignment in the case of horizontal surfaces, and horizontal levelling (from top) for vertical surfaces [10].
-Identification and measurement of depressions and other striking points according to fixed coordinates from the grid.
-Recording and analysis of the sound provoked by a striking PVC sphere using a rail (retrieval of measurable values: conditions, trajectory and intensity), through digital recorder and FFT-analyzer.
-Analysis of the vibration of the surrounding area.
-Conclusions.

5. DEDUCTIONS

The work carried so far points to a strong possibility of these rocks being used for sound production, either for rituals or simple signalling. The placement of the majority of these rocks is geo-strategic – even in the cases where the proximity to roads or villages interferes with the ideal conditions of near silence achievable in the past, we could 'hear' provoked rock knocks and human calling in the nearby hills. The most probable material used for striking would be hand-sized stones – metal or wooden objects are less appropriate. In a context of a group of rocks, only the ones bearing marks present resonating characteristics, distinguishable and sufficiently loud; the vibrations are felt in a large surface or in the whole corpus, contrary to normal rocks, which absorb or suffocate any impact. We also noticed that the cup-marks do not necessarily correspond to better sound production than the surrounding surface; the sound produced in the holes is similar to the one in the proximity within the same layer. We have observed that the sounding properties are related to the fractions on the rocks, and so closer to the edges of the platforms the amplitude and frequencies are higher. There are depressions which are naturally created and those which are probably a combination of both human hammering and erosion. When a whole surface of a rock is struck, depressions can be caused especially on weaker points, according to the different elements present in the rock. And natural erosion contributes to deepening the hollows. In the drawing we show a common consequence that explains some later or even non-sonant cup-marks: the hollow from a higher layer (possibly resulting from percussion) continues to the next layers (eventually also broken), which can be, or not, vibrating surfaces. We continue our work, since these and other wonders remain: how the sound is produced and how far and how does it reach long distances; human *vs*. nature incidence; which differences regarding material and intensities; ringing tones *vs*.

knocks; strategic chains of sound and the role of the rock formations; or how old were humans, when they struck and sang and music was 'conscientiously' born.



6. NOTES & REFERENCES

[1] There are still some ancient rites of fertility, for instance, like sliding, which some point as the major cause of erosion on some rocks.

[2] This is also true with human caused depressions, which is discussed later.

[3] Carvalho, C.N., "O "Parque Geomorfológico de Monsanto' através do seu percurso pedreste: As pedras para além do sagrado", Geonovas, Associação Portuguesa de Geólogos, Lisboa, n. 18, pp. 67-75, 2004. // Also by the author: "O mistério das '13 tigelas' de Monsanto" (pdf).

[4] One of the most recent monographs: Montagu, J., Origins and Development of Musical Instruments, The Scarecrow Press Inc., Lanham, Maryland, 2007.

[5] Fagg, B., "The discovery of multiple rock gongs in Nigeria", Man, pp. 17-18, reprinted in African Music, 1:3, pp. 6-9, 1956.

[6] Fagg, M.C., Rock music, Pitt Rivers Museum, Oxford, 1997.

[7] Henriques, F., Caninas, J.C., and Chambino, M., "Rochas com covinhas na região do alto Tejo português", Trabalhos de Antropologia e Etnologia, Sociedade Portuguesa de Antropologia e Etnologia, Porto, vol. 35 (4), pdf version, pp. 1-16, 1995.

[8] Thanks to the effort of Pedro Mendonça, who promptly helped us with both the visit to the Museu Arqueológico Municipal José Monteiro in Fundão and to Monte S. Brás.

[9] Rosa, J.M., Salvado, P., and Silva, A.C.F., Monte de S. Brás (Fundão): a persistência do passado na identidade, Cadernos do Museu Arqueológico Municipal José Monteiro, Câmara Municipal do Fundão, 2003.

[10] Methodology first described at the International Workshop on Diagnostics and Preservation of Musical Instruments: *On the field – universal measurement* (http://ravennamusicalinstruments2010.blogspot.com/p/programme.html).

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