Bibliography of Serra da Capivara - the project continues

Cristiane Andrate Buco *, Mila Simões de Abreu **, Maxim Simões de Abreu Jaffe ***, and Ludwig Jaffe ****

Introduction

The area of the Serra da Capivara in the south-eastern region of the state of the Piauí is one of most studied archaeological places in Brazil. Following the first discoveries over four decades ago, and then the initial work of the so-called "*Mission archéologique franco brésilienne*", researchers of the *Fundação Museu do Homem Americano* (FUMDHAM) and independent investigators from many countries and institutions have jointly advanced the knowledge of this zone (Fig. 1).

Serra da Capivara National Park

The Serra da Capivara National Park was established in 1979 and UNESCO placed the Park's numerous decorated rock-shelters on the World Heritage List in 1991. The park, with a perimeter of 214 km, covers an area of 130,000 ha in the municipalities of São Raimundo Nonato, Coronel José Dias, Brejo do Piauí and João Costa. (Jaffe, Abreu 2015 in this volume).

More than 1400 archaeological sites are known in the park and surrounding area (Fig. 2). They include decorated rock-shelters, open-air sites and historical monuments (Buco 2014). From the archaeological point of view, beside paintings and engravings found during excavations, many other materials came to light, including stone and pottery finds, human bones, and animal remains (mainly of mega-fauna). Research carried out opened opportunities for many other fields such as geology, paleontology climatology, sedimentalogy, chronology, and early man in the Americas (Fig. 3). The park and surrounds have also been the subject of studies as diverse as agriculture, tourism and health. The "caatinga", the typical vegetation of the area, has been studied from the point of view of distribution, as well as forming subject matter for fields like ethnobotany. Research on extinct fauna comprises work on different types of mega-fauna, including the *Lhama* (Fig. 4). The discovery of coprolites gave possibilities to dozens of specialists in parasitology to carry out umpteen studies and publish lots of articles. The presence of the oldest lice in the Americas and the discovery of seashells are among the curiosities of the area.

Bibliography project

The work of compiling a bibliography of Serra da Capivara (BSC) started with a request by Dr. Niède Guidon, President-diretor of the FUMDHAM. At certain point, due to funding difficulties, the FUMDHAM could not longer support the work. As the principal authors, Cristiane Andrade Buco and Mila Simões de Abreu, had already spent several months researching in libraries in Brazil, Portugal and the United Kingdom, they decided to continue the work. Likewise, much had been done on the informatics side, so Ludwig Jaffe and Maxim Simões de Abreu Jaffe continued development.

Web application

A beta version web application, powered by a NoSQL XQuery engine (Jaffe *et al*. 2014), was presented at the I Congress on "Global Heritage Management", 24-25 February 2014, that took place at the Instituto Federal de Educação, Ciência e Tecnologia do Piauí, in São Raimundo Nonato, Piauí, Brazil.

The web application gives access to nearly 800 entries. It is possible to search by author, year, and words or word-fragments (e.g., "rock engraving", "gravura" or "grav") in the titles of articles or books. An author search for "guidon" retrieves 120 references of Niède Guidon; a query by year for 2010 displays 56. Searching tiles for words produces 25 results for "archaeology"; searching by word fragments like "paras" shows 29 records with words like "parasite", "paleoparasitology" and "parasitoses" in the titles; likewise, "rupe" finds 121 entires with words like "arte rupestre", "gravuras rupestre" and "rupestrian".

The project previously tested two possibilities, BaseX (see http://basex.org) and eXistdb (see http://existdb.org/), and chose eXistdb. BaseX initially seemed unstable, but its features, compact distribution size and consistent development are reasons to reassess its use as the web application engine. It now supports XQuery 3.1, a candidate recommendation of the World Wide Web Consortium (W3C) (Robie, Dyck 2014) that extends the query capabilities of the language.

Continuing work is monitoring the production of new publications, as well as following fresh information processing developments, thus laying the ground for an improved service for bibliography compilers and questers.

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Fig. 1 - *Toca do Pajaú, o*ne of the many decorated rock-shelters of the Serra da Capivara National Park

Fig. 2 - *Toca do Meio*, rock-art and archaeological site Serra da Capivara National Park

Fig. 3 - The *Desfiladeiro,* one of the *Trilhas* of the park where is possible to visit many archaeological sites and observe wildlife

Fig. 4 - Screenshot of the search form of the "Capivara Bibliography" web app

Fig. 5 - The web app search form, author "Buco" and date "2009"

Fig. 6 - The results of the search.

The 2015 who's who in rock-art survey

Ludwig Jaffe * and Mila Simões de Abreu **

Introduction

The first edition of *Who's Who in Rock Art* (WWRA) was published in 1985 (Anati 1985); eleven years passed before the second edition came out in 1996 (Anati 1996). Thirty years after the first edition, preparations are underway for the third edition, which is being brought out to commemorate the founding of CCSP over fifty years ago in 1964 and in honour of the first editor, Ariela Fradkin Anati. A review of the changing world of rock-art studies —people, what they do and where — can only be written once the information has been collected. The immediate task is the survey and how best to capture the information; as such, the authors of this paper choose to refer to the information as capta rather than data (Jaffe *et al*. 2014).

A 'NoSQL' approach

In 1984, António Guerreiro used dBase (a relational database management system) for WWRA capta entry, retrieval and programming (Guerreiro 1985). In these times, WWRA is adopting an up-to-date NoSQL approach to structuring the capta, a formulation explained in a paper in the first volume and issue of *Alter Ibi*, entitled, Behind a 'NoSQL' approach in the development of a bibliography 'captabase' for rupestrian imagery (Jaffe *et al*. 2014).

NoSQL now broadly refers to a rapidly multiplying number of distributed systems that support hierarchical treelike notations for structuring capta (Roe 2012). Such notations do not require the use complex sets of relations to organize information and thus are considered 'non-relational', but that does not exclude the use of 'relational' queries (i.e., the possibility of constructing relations to 'join' separate sets of information). Conventional relational database systems incline to being 'ACID', which stands for atomicity, consistency, isolation, durability (Chapple 2014). NoSQL systems are comparatively fast and light as they avoid wholly conforming to the four ACID burdens.

Notations for structuring the capta

Three notations for structuring capta deserve attention—YAML (YAML Ain't Markup Language) (Ben-Kiki *et al*. 2009), JSON (JavaScript Object Notation) (Crockford 2008), XML (Extensible Markup Language) (Quin 2015).

YAML is easily understood by both humans and computers (see example below, followed by equivalent syntaxes in JSON and XML). Its apparent simplicity hides a capability for 'capta serialization', the process of translating capta structures into a format that can be stored in a file, in memory or transmitted across networks and subsequently reconstructed in similar or different environments. Various tools can convert YAML to JSON or XML and back again (see http://codebeautify.org/yaml-to-json-xml-csv).

```
YAML
---
email: project4dimensions@gmail.com
uri: http://cambridge4dimension.org
...
JSON
{
   "email": "project4dimensions@gmail.com"
   "uri": "http://cambridge4dimension.org"
}
XML
<?xml version="1.0" encoding="UTF-8" ?>
<root>
   <email>project4dimensions@gmail.com</email>
   <uri>http://cambridge4dimension.org</uri>
</root>
```

YAML is well suited for information capture. JSON is a leading notational format in the NoSQL world, providing much flexibility for structuring non-uniform content; implementations for storage include CouchDB (see http://couchdb.apache.org/), MongoDB (https://www.mongodb.org/), and recently eXistdb (see http://exist-db.org/) and BaseX (see http://basex.org/).

The relative merits of any notation depends on the power of languages that query and retrieve information from it. Full text search capabilities are pivotal, especially that of filtering records by finding text fragments within phrases (e.g., a search for "grav" should be able to select records with words like "gravure", "gravura" or "engraving").

Several mature open source projects such as eXistdb, BaseX and Saxon-HE (see http://sourceforge.net/projects/saxon/) implement the XQuery XML query language, which specifies functions to perform full text searches.

XQuery 3.0 is a recommendation of the World Wide Web Consortium (W3C) (Robie *et al*. 2014a); version 3.1 is a W3C candidate recommendation (Robie *et al*. 2014b)

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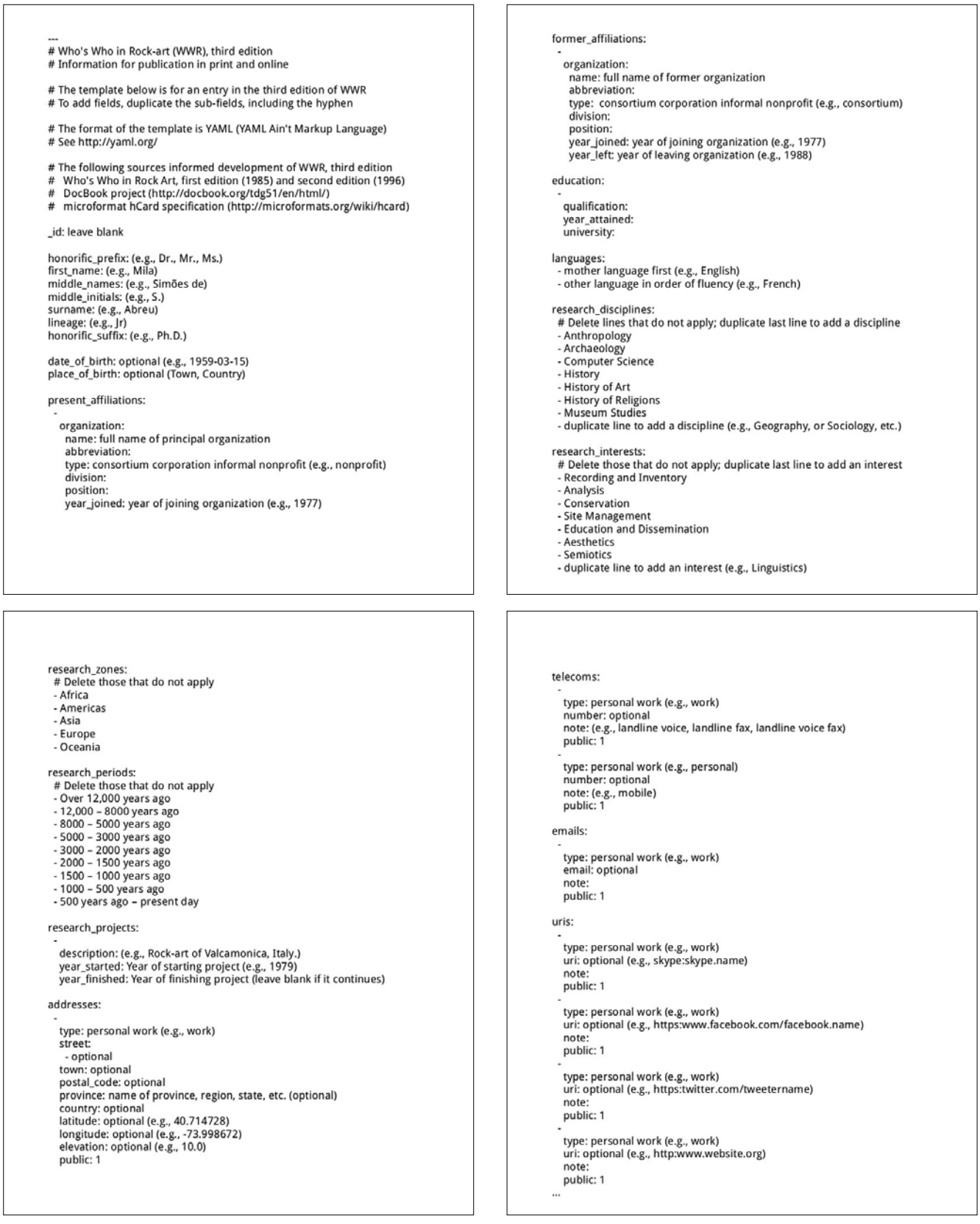
that extends the capability of the language to carry out queries on JSON structured capta.
A good strategy is one that can adapt to changing circumstances and makes choices that allow this flexibility. Given this, YAML would be a good choice for initially gathering information, which can then be easily converted to JSON or XML.
Mila Simões de Abreu manually produced the distribution maps for the first edition (Abreu 1985), a process that XQuery could automate to pass information to an application like QGIS (previously Quantum GIS), an open source geographic information system (see http://qgis.org).
Both BaseX and eXistdb support XQuery 3.1, thus keeping options open for the third edition of *Who's Who in Rock Art*.



```
---
# Who's Who in Rock-art (WWR), third edition
# Information for publication in print and online

# The template below is for an entry in the third edition of WWR
# To add fields, duplicate the sub-fields, including the hyphen

# The format of the template is YAML (YAML Ain't Markup Language)
# See http://yaml.org/

# The following sources informed development of WWR, third edition
#   Who's Who in Rock Art, first edition (1985) and second edition (1996)
#   DocBook project (http://docbook.org/tdg51/en/html/)
#   microformat hCard specification (http://microformats.org/wiki/hcard)

_id: leave blank

honorific_prefix: (e.g., Dr., Mr., Ms.)
first_name: (e.g., Mila)
middle_names: (e.g., Simões de)
middle_initials: (e.g., S.)
surname: (e.g., Abreu)
lineage: (e.g., Jr)
honorific_suffix: (e.g., Ph.D.)

date_of_birth: optional (e.g., 1959-03-15)
place_of_birth: optional (Town, Country)

present_affiliations:
  -
    organization:
      name: full name of principal organization
      abbreviation:
      type: consortium corporation informal nonprofit (e.g., nonprofit)
      division:
      position:
      year_joined: year of joining organization (e.g., 1977)

former_affiliations:
  -
    organization:
      name: full name of former organization
      abbreviation:
      type:  consortium corporation informal nonprofit (e.g., consortium)
      division:
      position:
      year_joined: year of joining organization (e.g., 1977)
      year_left: year of leaving organization (e.g., 1988)

education:
  -
    qualification:
    year_attained:
    university:

languages:
  - mother language first (e.g., English)
  - other language in order of fluency (e.g., French)

research_disciplines:
  # Delete lines that do not apply; duplicate last line to add a discipline
  - Anthropology
  - Archaeology
  - Computer Science
  - History
  - History of Art
  - History of Religions
  - Museum Studies
  - duplicate line to add a discipline (e.g., Geography, or Sociology, etc.)

research_interests:
  # Delete those that do not apply; duplicate last line to add an interest
  - Recording and Inventory
  - Analysis
  - Conservation
  - Site Management
  - Education and Dissemination
  - Aesthetics
  - Semiotics
  - duplicate line to add an interest (e.g., Linguistics)

research_zones:
  # Delete those that do not apply
  - Africa
  - Americas
  - Asia
  - Europe
  - Oceania

research_periods:
  # Delete those that do not apply
  - Over 12,000 years ago
  - 12,000 – 8000 years ago
  - 8000 – 5000 years ago
  - 5000 – 3000 years ago
  - 3000 – 2000 years ago
  - 2000 – 1500 years ago
  - 1500 – 1000 years ago
  - 1000 – 500 years ago
  - 500 years ago – present day

research_projects:
  -
    description: (e.g., Rock-art of Valcamonica, Italy.)
    year_started: Year of starting project (e.g., 1979)
    year_finished: Year of finishing project (leave blank if it continues)

addresses:
  -
    type: personal work (e.g., work)
    street:
      - optional
    town: optional
    postal_code: optional
    province: name of province, region, state, etc. (optional)
    country: optional
    latitude: optional (e.g., 40.714728)
    longitude: optional (e.g., -73.998672)
    elevation: optional (e.g., 10.0)
    public: 1

telecoms:
  -
    type: personal work (e.g., work)
    number: optional
    note: (e.g., landline voice, landline fax, landline voice fax)
    public: 1
  -
    type: personal work (e.g., personal)
    number: optional
    note: (e.g., mobile)
    public: 1

emails:
  -
    type: personal work (e.g., work)
    email: optional
    note:
    public: 1

uris:
  -
    type: personal work (e.g., work)
    uri: optional (e.g., skype:skype.name)
    note:
    public: 1
  -
    type: personal work (e.g., work)
    uri: optional (e.g., https:www.facebook.com/facebook.name)
    note:
    public: 1
  -
    type: personal work (e.g., work)
    uri: optional (e.g., https:twitter.com/tweetername)
    note:
    public: 1
  -
    type: personal work (e.g., work)
    uri: optional (e.g., http:www.website.org)
    note:
    public: 1
...
```

Questionnaire ('YAML' notation) for the third edition of Who's Who in Rock-Art (2015)

Nuovi siti di arte rupestre sui contrafforti della Catena dell'Orsaro in Lunigiana, Ms

Angelina Magnotta *

I siti scoperti da *ALATE* (Archeoclub d'Italia sede Apuoligure Appennino Tosco Emiliano) sono sei, si trovano tutti ad ovest del crinale appenninico che divide la Toscana nord occidentale dall'Alta Val Parma-Emilia. Le incisioni sono orientate verso Pontremoli, a SO

1 Sito della Glareda: scoperto nel 2013
GPS: 756m slm; 44° 22′ 41,68 N - 9° 57′ 36.71′′ E
N. rocce individuate: 40.
Descrizione del luogo: il toponimo in uso (dal latino *glarea* = ghiaia), potrebbe anche comprendere il termine *ara*, alterato nell'uso. L'area sulla quale insistono le rocce incise, porta i segni dei suoi vecchi terrazzamenti; è franosa e in declivio, vicina a un ruscello e limitrofa all'antica via di percorrenza tra il Passo del Cirone (Ne) e la cosiddetta Via Maritima (S-SO) per Luni e la foce della Magra. Le incisioni si trovano su macigni per lo più di grande dimensione, alcuni erranti per il detto effetto franoso.
Tipologia: per lo più si tratta di bassorilievi, con alcune eccezioni come una sorta di sedia ricavata da un blocco calcareo a sé stante, lavorato a forma di cubo profondamente inciso, dotato di canaletto a scivolo laterale. Le incisioni sono delle coppelle con vari significati simbolici per cui si rimanda alla sterminata letteratura in materia.

2 Sito della Laretta: scoperto nel 2014
GPS: 912 m slm; 44° 23′ 32,80 N - 9° 55′ 49′′ E
N. rocce individuate: 25
Descrizione del luogo: la denominazione forse comprende il termine *ara,* che nel toponimo risuona con maggiore evidenza che in quello di Glareda. Esso comprende tre concentrazioni prossime di siti: il Tecchio (grossa roccia che può fungere anche da riparo) dei Boschi Grandi, Groppo dei Cerri e Tecchio di Gostìn.
Tipologia: il sito, in deciso declivio, è caratterizzato da alcune particolarità specifiche come la presenza di una grande roccia concava montonata, detta Lo scivolo, residuo della glaciazione, non lontana da un mastodontico masso adorno di grandi coppelle subcircolari potenziate; tre rappresentazioni antropomorfe che appaiono di stile (e forse di epoche) differenti; molte coppelle di varie fogge; tre croci di cui una latina posta al culmine della roccia detta del Gigante antropomorfo; una croce ribattuta e infine un'incisione tondeggiante, di aspetto liscio e convesso, dove la croce è data da quattro *chevron* che si aprono verso l'esterno, mentre le punte convergono al centro.

3 Sito del Tecchio della Cancarina: scoperto nel 2014
GPS: 883 m slm; 44° 23′ 24,63 N - 9° 55′ 47′′ E
N. rocce individuate: 1
Descrizione del luogo: il sito si trova su terreno quasi pianeggiante, composto da un unico grande blocco calcareo, la cui superficie è interrotta da grotticelle naturali o ampliate per intervento umano.

4 Sito detto del Tecchio: scoperto nel 2014
GPS: 899 m slm; 44° 23′ 27′′ N; 9° 55′ 40′′ E
N. rocce individuate: 12
Descrizione del sito: posto al culmine della costa che dal ruscello sale all'altura, è preceduto da incisioni di varie dimensioni e forme. Lo spuntone di roccia (tipo tempio-pilastro) che presenta l'incisione principale, si sviluppa per circa mt. 8 in altezza e culmina con due segmenti di circonferenza opponenti, con effetto tipo testa coronata; a partire dalla base di circa mt. 4 fin quasi al centro della rupe, presenta un riparo aggettante sotto roccia la cui forma è riconducibile a un aspetto vulvare e misura internamente di larghezza circa mt. 3x2,50 nella massima estensione.

5/6 Siti di Gavatla e del Tursèl: scoperti nel 2014
GPS: 776 m slm; 44° 23′10′′ N; 9° 55′ 56′′ E
N. rocce individuate: 40
Descrizione del luogo: in un paesaggio primitivo, i siti sono collegati da due elementi comuni: il corso d'acqua torrentizio che percorre la vallata e la via megalitica di Gavàtla. La denominazione di Tursèl (Torricello) è verosimilmente dovuta a un macigno a forma di piccola torre, che taglia in due l'acqua del torrente. Le incisioni si trovano sulle rupi che fiancheggiano dall'una e dall'altra parte il torrente e i rivoli che vi confluiscono.
Tipologia: le incisioni, anche di notevoli dimensioni, sono di carattere antropomorfo, cosmogonico e naturalistico.

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Fig. 1 - Bassorilievo del masso: dimensioni 40x35

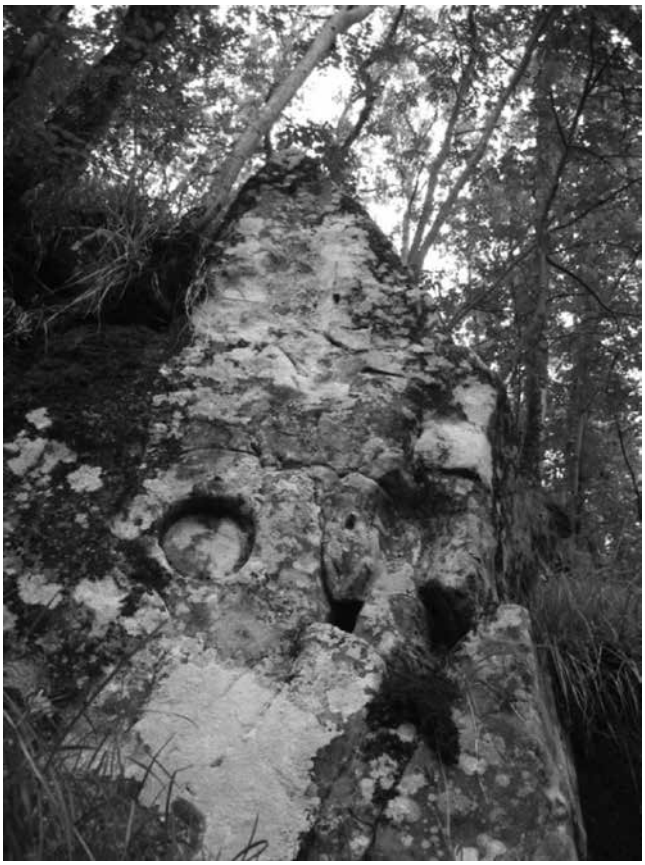

Fig. 2 - Menhir Gigante, dimensioni: mt. 4 alla base, mt. 8 in altezza

Fig. 3 - Macigno della Cancarina - Dimensioni mt.12 x 5,50

Figg. 4 a - b

Fig. 5 - Dimensioni lunghezza cm.15, di altezza cm.8, di larghezza cm.7; la protome misura di lunghezza cm.5, di larghezza massima cm.2

Rock-Art For All!
Preparing Sites For People With Special Needs

Tâmyris Rocha Santana Jaffe *, Mila Simões de Abreu ** and Tiziana Cittadini ***

Only a few archaeological areas are prepared to receive people with special needs worldwide. For rock-art sites, there are even fewer. Among the first difficulties are providing for differing special needs. These include not only people with vision impairment, in wheelchairs or that have other types of permanent disability, but also people with temporary impediments such as pregnancy and obesity, not to mention the debilities of the elderly. These different visitors require different types of site-preparation, which can be classed in two main spheres: physical access and information available. Perhaps not all sites can be visited by everybody, but many could and should. In some cases, access for people with locomotion difficulties can be provided by just enlarging paths and walkways, creating ramps and installing mechanic lifts. Positioning the information panels at suitable heights would not only help people in wheelchairs, but also of individuals of small statue and even children. Large and clear print can also make reading more comfortable to the elderly. Plates of braille could be easily placed alongside most panels. Among different types of heritage, rock-art is one of the most complex as access is often difficult. Many sites are on mountainous terrain, inside caves or in rock-shelters in dangerous cliffs. While access can be properly prepared for museums, churches or ancient ruins, matters are more complicated for rock-art sites. Concerns include issues related with conservation and preservation of painted or engraved sites. In recent years, efforts have been made to prepare some sites for these visitors. Two good example of areas with rock-art that have been prepared can be found in World Hertiage sites like Valcamonica (Italy) and National Park of Serra da Capivara, Piauí Brazil.

Dos Sotto Laiolo, Riserva Regionale Incisioni Rupestri di Ceto, Cimbergo, Paspardo (site prepared for the visual impaired).

In the case of Valcamonica, the area chosen was Dos Sotto Laiolo, a small but interesting site inside the Regional Reserve of Ceto-Cimbergo-Paspardo. The area was discovered, excavated and recorded in 1984 (Abreu *et al.* 1988). Seven decorated surfaces with more than six-hundred engravings were identified, most attributed to different periods of the Iron Age and a few to the Middle Ages. The zone was chosen because the decorated horizontal and sub-horizontal rocks are very close to each other and are easy to reach from a nearby parking area.

The intervention designed consists of a linear structure of granite blocks approximately 5 centimetres in height extending 80 metres from the parking area to the rock-art area. With a cane (Hoover bat), visual impaired visitors can follow the path safely and without help. Metal placards have been placed near the rocks. In addition to explanatory texts in braille about what can be seen on the rocks, there are also relief reproductions of the most interesting figures (Figs. 1-3).

National Park of Serra da Capivara, Piauí (wheelchair access).

At the Parque Nacional Serra da Capivara, seventeen sites, with paintings and engravings along three different circuits ("trilhas") have been made accessible for people in wheelchairs (Figs 4-5). They include zones such as Baixão da Pedra Furada, Jurubeba and Baixão do Perna, making it possible to visit the world famous site Boqueirão da Pedra Furada, where vestiges place this among the earliest occupations of the Americas, as well as, rock-shelters such as Toca do Sítio do Meio and Casa do Alexandre. Visitors with limited mobility can also see the belvedere of Baixão das Andorinhas and appreciate one of the most beautiful views of the Park. To make this possible, Elizabete Buco, the architect of the FUMDHAM, the body in charge of the Park carried out a project where the access barriers were eliminated, creating ramps, putting in handrails and by reinforcing walkways for safety.

A group that, as far as we know, has been left apart are deaf people or those with hearing impairment. If, in many cases they can read and so have access to written information, they are often left behind in sites where guides are needed or in cases where films or other type of audio-visual information is available.

One way of improving this situation and which is easily implemented, would be for guides to use of mobile apps that translate text or speech into sign language such as Hand Talk (http://www.handtalk.me/app), ProDef (http://www.prodeaf.net/) and Mimix (http://www.mimix.me/). MotionSavvy (http://www.motionsav-

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vy.com/) provides also interesting products and services that allows sign language to be translated to text or speech but it requires specialized equipment and a significant investment. A project to prepare a simple App. that would use QR code in panels to provide additional information and media is being now planned for sites in the Côa Valley and eventually also for sites in Valcamonica.
Simple actions can transform rock heritage to be truly accessible to everyone.

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Anonimo
s.d. *Parque Nacional Serra da Capiavara. Acessível a todos*, São Raimundo Nonato, Fumdham, Parque Nacional Serra da Capivara, Ibama.

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2014 *Um parque para todos...? Acessibilidade inclusiva*, in «Alter Ibi» 1(1), pp. 159-169.

Figs. 1-3 Italy, Riserva Regionale Incisioni Rupestri "Ceto-Cimbergo-Parpardo", Dos Sotto Laiolo site prepared for the visual impaired, panels with braille texts and images in relief (Photo archive CCSP)

Figs. 4-5 Brazil, Serra da Capivara National Park, Piauí. Different wheelchair access paths a decorated rock-shelters – Toca do sitio do Meio, Coronel José Dias (Photos MSA – projeto 4 Dimensões)

The illusion of numbers: a case study for sustainable tourism in the Serra da Capivara National Park, PI - Brazil

Maxim Simões de Abreu Jaffe * and Mila Simões de Abreu **

The World Heritage List and Tourism

Since the UNESCO General Conference approved the World Heritage List (WHL) in 1972, a WHL listing progressively became synonymous with thriving tourism (Frey *et al.* 2013).

Visitor numbers increased for most monuments after achieving World Heritage Site (WHS) status (cultural, natural or mixed)—even more notable for sites outside big cities or the already renown ones. Studies found the remoter the place, the greater the apparent impact (Van Der Aa 2005, p. 139). The city of Petra in Jordan is good example. Distictly popular before its listing in 1984, visitors numbers soared from 40,000 to 800,000 between 2004 and 2010 (number of the most visited ruins). Nevertheless, circumstances like the "Arab spring" and nearby wars reduced the number to 400,000 (Anonymous 2015a).

UNESCO is well aware of the efforts that must be made to properly manage classified sites and published texts and promoted meetings worldwide (Albert *et al.* 2007; Pedersen 2002; Stolton *et al.* 2012; Wijesuriya *et al.* 2013; Agnew, Demas 2013).

The economic value of a WHS label has been the subject of numerous documents (Blacik 2007; Kayahan, Vanblarcom 2012). In his thesis, *Preserving the heritage of humanity? Obtaining world heritage status and the impacts of listing,* Bart J.M. van der Aa (2005) affirms "*Decentralized nominated sites benefit from the high-standing status of the world heritage list* […it] *could have a positive impact on managing these sites, as visitors presumably only continue to visit high-quality environments*". Some communities benefit hugely from the influx of visitors, as in Kenya (Jaffe M., Abreu 2014), but it can take years before locals feel any advantage, as is the case of the Douro Valley WHS, Portugal (Lourenço-Gomes 2012; Rebelo 2015).

Few studies have been made on the impact of WHL status on rock-art sites. The prospect of being a WHS was important to saving the Côa Valley Rock-Art, but it was only following criticism (Abreu 2003) that visitor numbers increased in the last years, mainly due to changes in the organization of visits and the inauguration of a state-of-the-art museum (Fernandes *et al.* 2008).

Many classified areas such as cave art sites require stringent conservation measures that severely constrain visitor numbers. The issue, hotly debated for decades, has been recently reignited by the cases of Altamira and Lascaux (Bastian, Alabouvette 2009; Saiz-Jimenez *et al.* 2011). Solutions include partial and total replicas of the caves, so easing pressure on the originals, as in Chauvet, in France (Morelle, Denman 2015).

The case of the Serra da Capivara National Park

The Serra da Capivara National Park, located in the south-eastern region of the state of the Piauí, Brazil, was established in 1979 following the archaeological works of a Franco-Brazilian mission coordinated by Niède Guidon. The park, with a perimeter of 214 km, covers an area of 130,000 ha in the municipalities of São Raimundo Nonato, Coronel José Dias, Brejo do Piauí and João Costa. UNESCO placed the Park's numerous decorated rock-shelters on the WHL (*III* criteria) in 1991. Many paintings and engravings were made between 10,000 to 8000 years ago, with several late Pleistocene dates attributed to the lithic industry (Boeda *et al.* 2014).

The Park is managed jointly by the *ICMBio* and *Fundação Museu do Homem Americano* (FUMDHAM). IPHAN has the responsibility of oversight and conservation. For the last decades, scientific investigation has been mainly carried out by FUMDHAM researchers, leading to the identification of over 1300 archaeological sites. The Park prepared 17 circuits for visitors, including sites that can be accessed by people in wheelchairs (Jaffe *et al.* 2014). In 2009, IFRAO, with the support of the State Government of Piauí, organized the "Global Rock-art International Congress" in São Raimundo Nonato, bringing more than 800 participants from all over the world (Guidon *et al.* 2010).

The potential economical value of tourism to the area surrounding the Park is easily understood, but visitor numbers are still low. There are no official numbers for the last years; however, as reported in 2008, the number of tourists per year was between 6000 to 10,000 for the period of 2000 to 2007 (Anonymous 2008, p. 20); unconfirmed figures suggest this could be around 20,000. Recently, regarding the inauguration of the area's new airport, the Brazilian media echoed words of FUMD-

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HAM's President-director, Nièdе Guidon, affirming the area could have 6 to10 million visitors every year (Anonymous 2015b). Evidently, there was a calculation error. Could a city with a population of 21,000 accommodate16,000 new visitors every day? Could the airport handle over 50 daily flights (arrivals only), each with some some 300 passengers? This would be higher than the airport of Fortaleza, one of the main tourist destinations of the *Nordeste*. The total number of visitors for all protected areas of Brazil in 2014 was close to 7 million, the year that Brazil hosted the World Cup. It is not easy to foster the idea that there must be a balance between the number of visitors and the conservation of rock-art.

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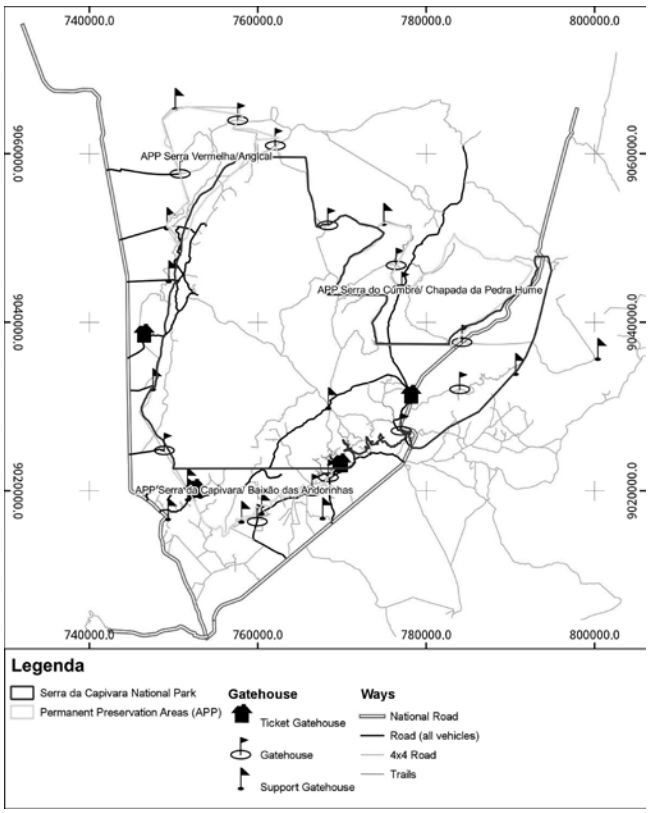
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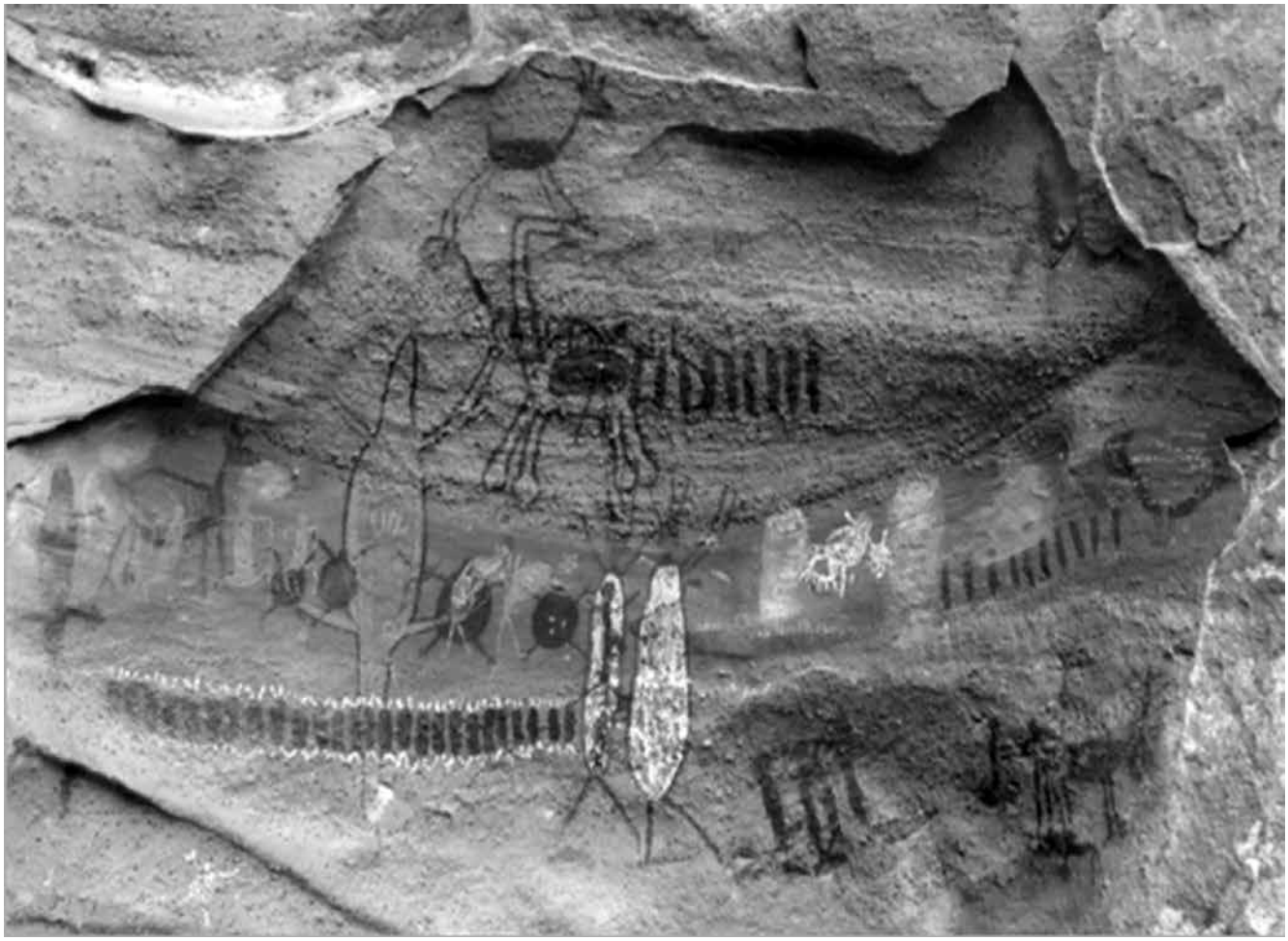
APP Serra Vermelha/Angical
APP Serra do Cúmbre/ Chapada da Pedra Hume
APP Serra da Capivara/ Baixão das Andorinhas
Legenda
Serra da Capivara National Park
Permanent Preservation Areas (APP)
Gatehouse
Ticket Gatehouse
Gatehouse
Support Gatehouse
Ways
National Road
Road (all vehicles)
4x4 Road
Trails



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