

THE EASTER ISLAND STATUE PROJECT (EISP), GPS MAPPING OF RANO RARAKU INTERIOR AND MOAI CONSERVATION

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EL PROYECTO DE ESTATUARÍA DE ISLA DE PASCUA (EISP), MAPEO GPS DEL INTERIOR DE RANO RARAKU Y LA CONSERVACIÓN DE LOS MOAI

RESUMEN

Este documento es el informe de situación de 2004 sobre el Proyecto de Estatuaría de Isla de Pascua (EISP), un inventario arqueológico destinado a localizar y documentar cada escultura de piedra (moai) en Rapa Nui. El objetivo de la investigación es reunir grandes cantidades de datos objetivos de un modo sistemático, y utilizar estrategias de análisis de datos que permitan el reconocimiento de los patrones principales, definir la norma de diseño e ilustrar normas culturales. Hasta hoy día, el EISP ha producido una base de datos con 10,000 registros sobre 887 moai en 210 sitios (de un total estimado de 313 sitios de moai dentro de 4 de los 10 tipos de sitios), incluso 40 estatuas de piedra en 15 museos. Nuestra base de datos es amplia, pero también profunda. Se han rescatado decenas de archivos con registros de excavaciones no publicadas (de 1868 a 1960, incluyendo la colección privadas de imágenes de Alfred Métraux) para reconstruir historias estratigráficas de moai específicos. El formato de la presentación de la base de datos EISP es nuestro mapa GPS del interior de Rano Raraku. La base de datos EISP es una herramienta de investigación sólida, vital para el manejo de sitios culturales en toda la isla. Este documento describe cómo los datos del estado de conservación de los moai en el EISP, tomados de manera consistente desde 1982 y recientemente incrementados con la ayuda del personal de Getty Conservation Institute, son básicos para la restauración, conservación, o reconstrucción de casi todos los moai.

INTRODUCTION

The Easter Island Statue Project (EISP) is an archaeological inventory designed to locate and document every monolithic stone sculpture (*moai*) on Rapa Nui. Our research purpose is to amass large quantities of objective data in standardized ways, and to employ data analysis strategies that enable recognition of principle motif patterns, define the design canon and illustrate cultural norms. To date, the EISP inventory has yielded 10,000 database records on 887 monolithic *moai* on 210 sites (of an estimated total of 313 *moai* sites within 4 of 10 site types), including 40 stone statues in 15 museums throughout the world (Van Tilburg 2005). This paper describes three aspects of the project: the collection and maintenance of raw data, database strategy and management, and statue environmental damage and condition assessment reports.

THE EISP DATABASE

The EISP database consists of an archaeological site inventory and an interfacing image catalogue. It is a comprehensive, interactive, searchable computer-based file of all *moai* data collected by Jo Anne Van Tilburg (1982-present), Cristián Arévalo Pakarati (1989-present), and their teams during seasonal archaeological fieldwork on Rapa Nui. It contains the following categories of data types: quadrant descriptions and images; site and statue GPS map locators; site and statue images; site and statue type definitions; statue measurements; site descriptions; narrative field notes; statue condition reports and a visual conservation glossary; cross-reference identifiers; po-

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litical divisions; historical and ethnographic observations, and survey and excavation histories.

The database is stored on three computers, two of which are at UCLA and the other on Rapa Nui. All three are maintained, backed-up, and updated by the EISP database manager. Programs employed include Portfolio 7 for image database management, Microsoft Access and Excel for metric and other data management, and Adobe Photoshop and Illustrator for image editing. The Statdat metric database (1 to 55 measurements on every statue documented) is managed by the SAS statistical package. Micro station GIS and GPS tools and AutoCAD are used for mapping data management.

Our database is broad, but it is also deep. It contains hands-on documentation of museum objects, including monolithic statues, stone carvings, woodcarvings, rock art, and other ritual objects directly related to *moai* iconography. We have salvaged unpublished excavation records (dating from 1868 to 1960) from dozens of public and private sources. Unpublished field notes describing excavations conducted by Katherine Routledge of the Mana Expedition to Easter Island, 1914-15, have been deciphered and filed with the appropriate statues whenever possible. These records allow us to reconstruct stratigraphic histories of specific *moai* in Rano Raraku. (The number of statues that were dug in Rano Raraku between 1914 and 1980 without archaeological controls or documentation is very large).

Supporting data include hundreds of non-EISP images and measurements of *moai* provided by individuals and nearly all major curatorial institutions. The Alfred Métraux photographic collection held by his estate is included, as are museum collection images donated by the descendants of Henri Lavachery, his colleague on the Franco-Belgian Expedition to Easter Island, 1934-35. The EISP database is a robust analytical research tool that is incredibly useful in integrating a vast quantity of information. It is also critical to island-wide cultural site research, reconstruction, preservation and management.

PREVIOUS ARCHAEOLOGICAL SURVEY AND STATUE INVENTORY

Cristino et al. (1981) give a history of the island-wide archaeological survey and detailed maps of Quadrants 1-14, 18, and 28, each of which was produced by various researchers over the history of the project. In these maps, located sites are identified by consecutive numbers within individual quadrants. Site descriptions or site type classifications, however, are excluded. Van Tilburg (1986) documented the statues within these quadrants given in McCoy's (n.d.) field notes and on a University of Chile site list, reporting them by discrete trinomials (quadrant number, site number, and statue number).

Quadrants surveyed by Universidad de Chile teams from 1981 to 1996 include portions of 15, 16, 26, 32, 34, 35, and 20, as well as 17, 22, 23, 24, 25, 27, 28, 31, and 33 (Vargas 1988, Figure 1). Statues found within them were independently located and documented (Van Tilburg 1988, 1990, 1994). For a detailed overview of all statue inventories, please see Van Tilburg and Vargas (1998:187-194). EISP metrics for 1994 were compared with Vargas' records but otherwise all files are discrete.

Raw survey data collected to 2004 form the core of the EISP database, and its design requires the continued employment of the established trinomial system. This, in turn, demands continued collaboration with the individuals or agencies responsible for overall survey strategy. In some cases, EISP has assigned temporary site and statue numbers within the quadrant system. These will ultimately need to be abandoned and official numbers inserted. Our GPS map of Rano Raraku interior will be the organizing system for reporting all EISP statue site and style data.

PREVIOUS MAPPING IN RANO RARAKU

Maps and images created by Chilean governmental agencies over three decades were reviewed apparently in preparation for creating the published map of Rano Raraku (Cristino and Vargas 1980; Cristino et al. 1981). A key base document was the plan of the volcano created by Lt. D. R. Ritchie of the Mana Expedition to Easter Island in 1914 (Routledge 1919, Figure 44; Van Tilburg 2003:166-169). Five archaeological zones were created in Rano Raraku: interior and exterior slopes, interior and exterior quarries, and upper exterior quarries (Vargas 1988:136). The 396 statues recorded were numbered, systematic measurements were taken, an attribute list was created, a typological strategy was devised, and a summary report of size and distribution was published (ibid.).



Figure 1. Plan of Rano Raraku, Mana Expedition to Easter Island, 1914-15. (Courtesy Royal Geographical Society with the Institute of British Geographers).

Two quarry zones, designated C and D, were outlined.⁵ A detailed map of these zones was not created; statues were not described.

The goal of EISP's seasonal mapping effort in Rano Raraku was to map all statues, outline the *papa*, and detail the quarries in Areas C and D; to compile a contour map of the area showing the main topographical features, and to localize all previously mapped and numbered statues that are standing or fallen on the interior slopes. Documents created by the Mana Expedition to Easter Island, including the unpublished plan showing

⁵ Quarries were sketched and those statues that were identified were outlined with two points each, at the base and at the head (P. Vargas, personal communication). These data were not consulted by EISP.

datum points, the statues on interior and exterior slopes and their orientations, and historical walls and roads were consulted (Figures 1 and 2).

Surveying was accomplished by J. Van Tilburg and C. Arévalo Pakarati with Dr. Peter Boniface (in 2002 and 2003) and Matthew Bates (in 2004), both of California Polytechnic University, Pomona. We were supported by a team composed of UCLA Rock Art Archive staff and volunteers and Rapa Nui resident participants. EISP field teams worked 75% of total allotted on-island field time in Rano Raraku and the balance in their Hanga Roa digital lab. Lab tasks included field work logistics planning, survey equipment shakedown, data analysis, image processing, image cataloging, data importation, map drafting and design, website maintenance, and report preparation.

An existing GPS station approximately 10 km west of Rano Raraku was established by NASA in 1998. In 2000, we placed our survey on the GPS datum WGS 84 and the UTM (Universal Transverse Mercator) projection zone 12. This is the same projection as was used for the previous survey by the University of Chile team and, therefore, provides consistent data. We established four base stations in Rano Raraku on the south side of the volcano and marked each by steel pegs placed level with the ground. These are located away from the main path and not ordinarily visible to passersby. Another three points were established in Area C and marked by wooden pegs driven in flush with the ground. These pegs were also placed away from paths so that they would remain inconspicuous and undisturbed.

The positions of the statues in all interior quarries of Areas C and D were surveyed to centimeter level accuracy using two Ashtec GPS single frequency satellite receivers to gain latitude, longitude and elevation above sea level. The attitude of the statues was also recorded: the direction in which the statue faced; the forward slope, and the sideways/lateral slope.

The exact position, total length, total height above ground, compass orientation, tilt, and circumference of every non-quarry statue, standing or lying on the slopes of both the interior and the exterior of the volcano, were also recorded. Statue condition reports were completed on every one of the statues in the interior and on all of those implanted or lying on the exterior slopes. Digital and standard photography, sketches, and measurements as appropriate were accomplished.

In 2004, we used a Trimble 5700. Our major field emphasis was the collection of additional mapping points that would allow the further exposition of design details on selected statues and quarries. The pace of work was approximately 300 survey points collected per day for a total of 2200 points collected in Sections C and D.

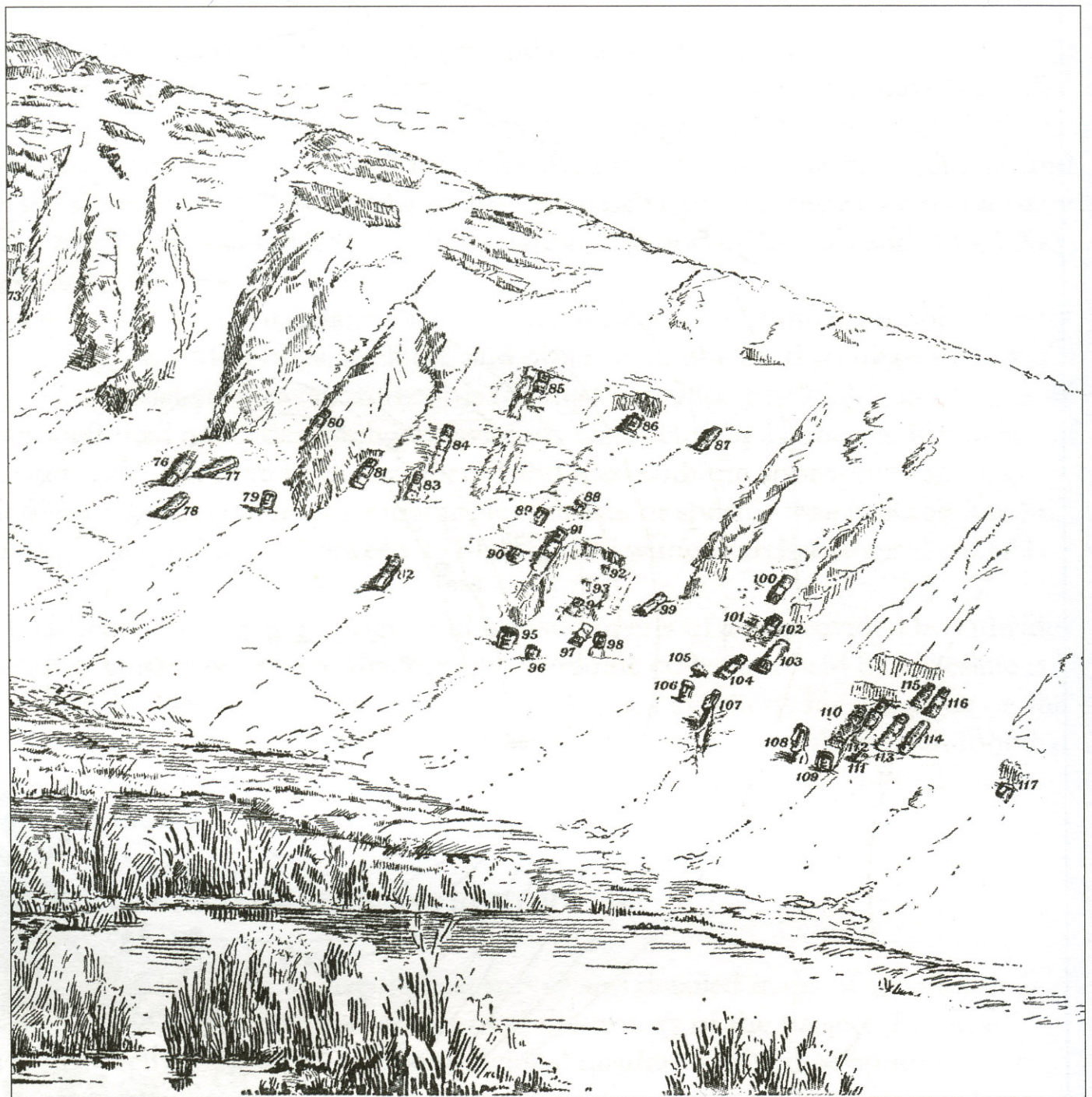


Figure 2. Portion of diagrammatic sketch, Area C, Rano Raraku interior. Mana Expedition to Easter Island 1914-15.

Our GPS map is supported by satellite photography of Rano Raraku in its entirety. The final purpose of our map, other than to complete Rano Raraku site documentation, is to act as a coordinating and organizing tool for the interactive presentation of the EISP image and statue inventory databases.

This goal includes, whenever possible, clarifying the historical and archaeological contexts of past excavations in Rano Raraku.

MAPPING PROBLEMS ENCOUNTERED

A few interior quarry features previously mapped (Cristino et al. 1981) were impossible to relocate without additional identifying information.⁶ Statue RR-001-287, originally mapped and documented by the University of Chile team and then documented by EISP in 1984, has deteriorated badly (Figure 3)⁷. However, the EISP database contains full metric and photographic documentation on this figure. On the exterior slopes, eight statues or possible statues numbering RR-002-209, 215, 216, 226-228, and 231-232 were not relocated due to new rock falls or erosion of identifying features. In a few instances, the orientations, head/base relationships or minor archaeological details (i.e. presence or absence of *taheta*) of several statues on both the interior and exterior were inaccurately indicated on the University of Chile map (Cristino et al. 1981). These small anomalies have been rectified. The entire base periphery of Rano Raraku has been disturbed. A large number of previously mapped archaeological features known as hare paenga are today displaced or demolished; many can no longer be re-located as a result of erosion and/or livestock activity.



Figure 3. Photo (left) by D. C. Ochsner, 1984, and sketch (right) by C. Arévalo P., 1991, of Moai RR-001-287.

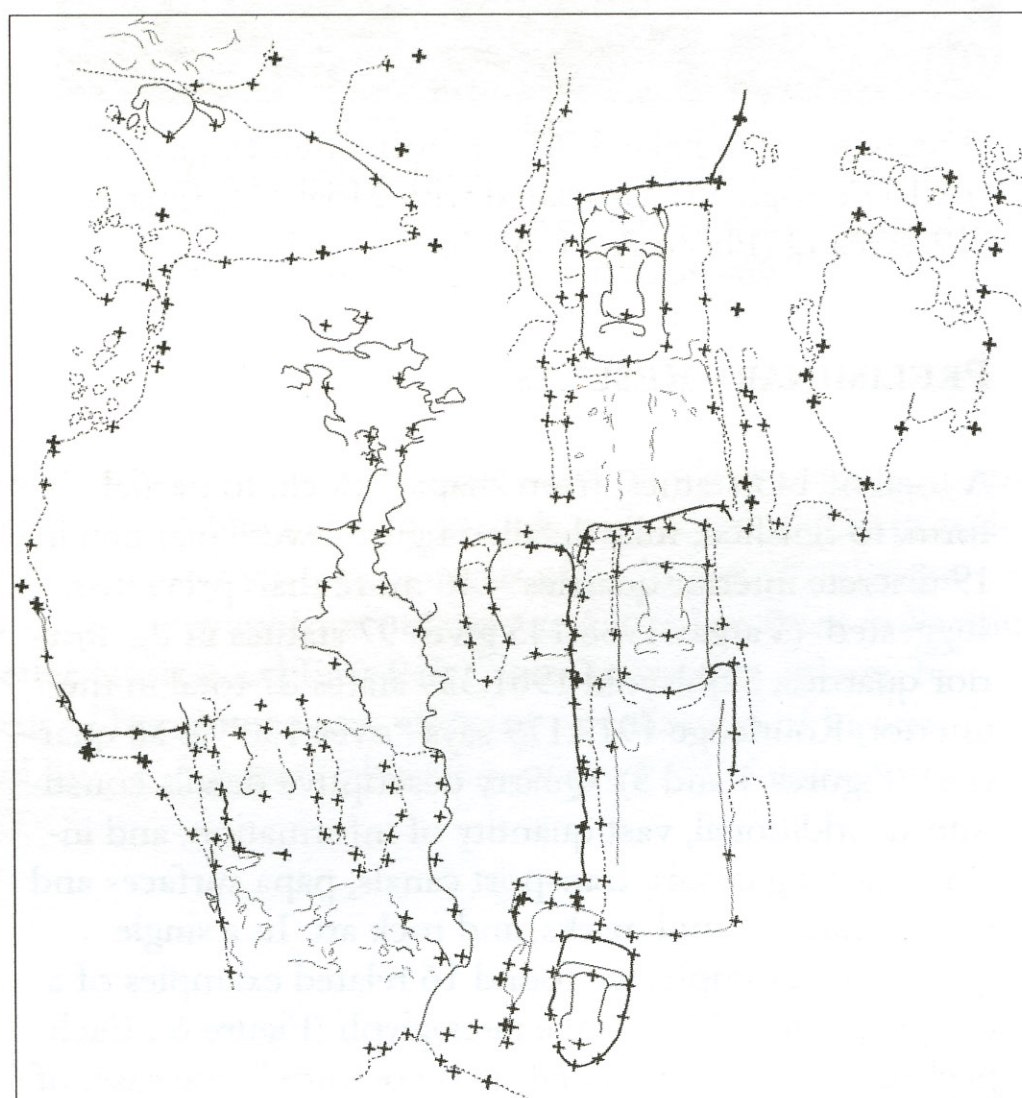


Figure 4. Draft survey map showing Moai RR-03C-53, in Quarry 8, Area C.

⁶ Skjølsvold 1961: 360 notes work done in the "Kanapu" region.

⁷ For a photo of C. Cristino with this statue see Zuber (1980:107).

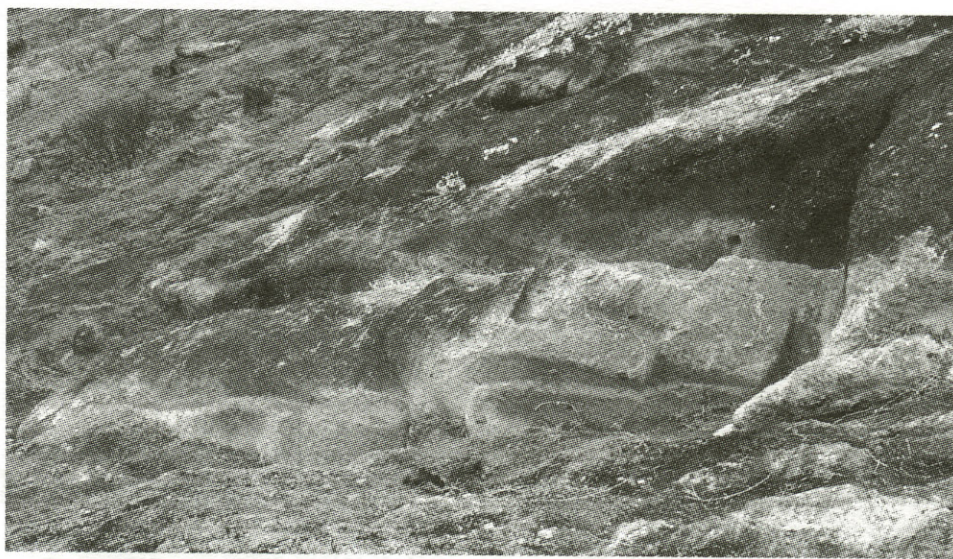


Figure 5. Moai RR-03C-53, Quarry 8, Area C (Photo B. White and D. Isaac, 2002).



Figure 6. Makemake 5 (67 cm horizontal length), 1 of 16 petroglyphs associated with Moai 115, Quarry 19, Area D (Photo A. Hom, 2002).

PRELIMINARY RESULTS

A total of 143 statues, from shaped block, to partial form, to finished, fully detailed figures, were mapped in 19 discrete interior quarries – 46 more than previously suggested (Vargas 1988:145 gives 97 statues in the interior quarries; Skjølsvold 1961:339 states 87 total in the interior; Routledge 1919:179 says “over 150” in all quarries) (Figures 4 and 5). Quarry descriptive details constitute an additional, vast quantity of information, and include carving canals, transport canals, papa surfaces and configurations, tool marks, and rock art. In a single quarry, for example, we found 16 related examples of a unique form of Makemake petroglyph (Figure 6). Each pecked face was composed, as is commonly the case, of two eyes and a nose. The noses, now broken, had been carved as hooked and protruding from the vertical face of the quarry. The septum of each had been pierced, allowing an unknown object (a gourd?) to be suspended by a cord threaded through it.

None of the individual quarries are directly



Figure 7. Moai RR-001-241 excavated by the Mana Expedition to Easter Island, 1914-1915. (Courtesy Royal Geographical Society with the Institute of British Geographers).



Figure 8. Moai RR-001-276 (torso, foreground) and RR-001-277 (standing, background), 1957 (Photo J. M. Ramírez).

linked, but internally some of them show a degree of planning. Some quarries appear to have been practice or teaching areas for such important features as statue heads and faces. As Routledge (1919:179) noted, narrow carving canals, some very steep and dangerous, are cut into the bedrock alongside and at the top and bottom of roughed-out blocks. These average about 50 cm wide, and some are stepped. Carvers stood in these canals to work.

While it has been noted that there are many phases of statue carving, six basic stages or steps are, in general, universal. The first was to shape a rectangular block. While Routledge (*ibid.*) states that, “in a few cases, the stone has been roughed out into preliminary blocks,” we agree with Skjølsvold (1961:367) that shaped blocks were nearly always the first step in the interior quarries. A shallow groove was then cut in from each side of the block at the neck. Next, the faces were carved. This is in keeping with the ritual importance of the head and face, but the elongated nose also created a midline that made it easier to take the next step: the accurate positioning of torso details. Undercutting the statue for removal usually began at the same time. The last step was to brace the statue in place prior to removing it from the quarry (Skjølsvold 1961:368).

Obviously, it is easiest to apply upper surface details to a carving when it is lying in the prone position, although a few statues in the interior quarries are in lateral positions. It is also widely agreed that the upright position allows carvers to finish and detail the backs of statues (Routledge 1919:188; Skjølsvold 1961:369). That is not, however, the full explanation for the twenty statues implanted upright in the interior slopes.

Ten upright statues in the interior were excavated by the Mana Expedition (Figure 7). One was excavated, possibly re-excavated, by the Norwegian Archaeological Expedition. Mana Expedition excavations in Rano Raraku exterior are visible in the 1934-35 Franco-Belgian Expedition photographs on file with EISP. At least two interior statues were dug by or in the presence of one Ruperto Vargas in 1957, and at least six others on the exterior were dug in the 1960s (Figure 8).⁸ Our analysis of cumulative image data and reconstruction of excavation histories reveal that all excavated, upright interior slope statues probably “stood free” (Skjølsvold 1961:359). In one case, a statue was implanted in a hole dug out of solid bedrock, an obviously unnecessary and labor intensive effort if ultimate removal was intended. Secondly, all were then deliberately backfilled in a probable effort to protect them and to allow them to remain standing. These data are not in conflict with excavation data from exterior slope statues (*cf.* Skjølsvold 1961; Routledge 1919), where most were found to be standing on prepared pavements.⁹ As Routledge (1919:189) suggested, a large number of statues were apparently “intended to remain” upright on the slopes of Rano Raraku and were not “merely awaiting removal to an *ahu*.”

RESEARCH VALUE OF THE DATABASE

The value of the EISP database is that it supports reconstruction of the prehistoric Rapa Nui human population as a component of ecological, political, and other systems. It combines analytical tools with social theory to contribute a unique perspective on island change. Its use facilitates the semiotic analysis of prehistoric Polynesian spatial organization. It is complementary to other ecological, geographic, economic, and social analyses in Pacific Studies, and integrates Rapa Nui into the larger and better understood East Polynesian interaction sphere. Finally, it provides insight into the long-term development of human systems, allowing visualization of historical and ecological linkages of the past with the present and future. A paper publication of the EISP database is anticipated in 2007 followed by a digital publication.

⁸ The name “Ruperto Vargas” and the date 1957 are written on the back of the photograph given here as Fig. 08 (EISP External Collections A18_JMR_P0003.tif for RR-001-276; J.M. Ramírez-A, pers comm. 2002). Norwegian Archaeological Expedition excavations are clearly visible in the Lorenzo Domínguez Photographic Collection, 1960, as are at least 6 freshly dug standing statues on the exterior slopes of Rano Raraku (EISP External Collections A01 and A21, *cf.* LD_W34-19.tif for RR-002-077).

⁹ Skjølsvold (1961:359) assumes that “almost 4 m of debris” had collected naturally around one statue (his no. 400 on the exterior) “since the time of erection.”

STATUE CONDITION REPORTS AND THE CONSERVATION VALUE OF THE DATABASE

Statue condition reports were completed on all statues in the database prior to 1986. These condition reports are all subjective, comparative observations of statue condition. In 2004, our condition reporting system was reviewed by members of the Getty Conservation Center staff. As a base-line inventory with time depth, it was deemed a useful tool for conservators; however, some categories of data were revised, redefined, or renamed. These new-format statue condition reports were then completed by 2004 team members for every statue documented in the interior slopes and quarries, and for those standing or fallen on the exterior. The new-format statue condition reports are now standard to the EISP database.

Volcanic tuffs, including those of the type found in Rano Raraku, are extremely vulnerable to natural weathering as well as to human destruction (Van Tilburg 1990). Yet, they have "not been studied worldwide as thoroughly" as other stone types (Charola 1990). Extensive test-treatments of Rano Raraku and other volcanic tuffs have been carried out (Bahamondez P. 1990), and various substances have been investigated as possible stone consolidates. A joint Chilean-Japanese initiative to dry out and then to chemically consolidate the stone on selected statues at Ahu Tongariki was undertaken in March 2004, and further such efforts are contemplated.

Our initial, informal analysis of observational data collected on the stone surface condition of statues in virtually every part of the island illustrates a truly alarming deterioration. Every single statue in the interior of Rano Raraku is in poor or extremely poor condition. Every statue suffers from near-complete erosion of the stone surface, and decomposition is universal. Structural problems include de-lamination as well as fine, hairline cracks that sometimes widen to become deep fissures. Statues are needlessly and repeatedly damaged by misdirected or unaccompanied tourists walking or climbing on them. Our map contains the existing pathways used by tourists. All but one of them negatively impact statues.

Statues standing on the interior slopes are repeatedly abraded or broken by livestock. Mosses, and lichens in three discrete stages of growth and fertilized by bird droppings, are rampant on statue surfaces. Grass and grass seeds, in the words of one of our Rapa Nui field colleagues, are "eating the *moai*." A comparison of images taken of a single statue over the 90 years between 1914 and 2004 shows weathering to near-complete loss of design detail. Some of the statues, in fact, have passed the point of no return; the only evidence available of their former appearance is that contained in the EISP database.

CONCLUSION

The interior of Rano Raraku is a highly vulnerable site composed of interfacing ecological and cultural zones. Sustainable visitor management is immediately required to insure visitor satisfaction and safety, as well as site protection in perpetuity. Two environmental issues require immediate mitigation. First, dense shrubbery (and the resultant moisture retained in the soil and released into the environment immediately adjacent to standing statues) must be controlled or eradicated. Secondly, excessive damage is being done to the stone surfaces of incomplete statues by visitors climbing, sitting and walking upon them. It is crucial to immediately adjust the use of multiple, often conflicting or unnecessary trails, and perhaps to move visitors completely away from interior quarries. A single visitor trail, winding along the base of the interior slope in front of standing statues, will direct visitors through a more resistant or resilient area. Increased visitor education, direction, and monitoring by guides and park guards are essential.

Marion and Farrell (2001:224) discuss visitor use-related impacts in national parks in Central and South America. They demonstrate a range of rapid assessment techniques currently available for documenting the negative impact of tourism in vulnerable areas such as Rano Raraku. They illustrate management techniques that are well-established and available to minimize negative visitor impacts, and outline a variety of means available to reduce barriers to effective visitor monitoring (including the universal problem of limited funding and staffing).

A pilot plan for the preservation of Rano Raraku as an archaeological and cultural site and the improvement of visitor services has been developed by a coalition of island agencies (CONAF et al. 2001). *We strongly support this effort.* We suggest that successful cultural management of the patrimony of Rapa Nui can be enhanced through input provided by archaeological research and, specifically, by the EISP database. In November of 2004, we provided CONAF with the first draft of our interior map, to be used as an aid in the first stage of the work being done to adjust the tourist paths on the interior and exterior of the quarry.

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The EISP website www.easterislandstatueproject.org reports aspects of on-going fieldwork on the UCLA server, and is linked to major research institutions throughout the world at www.sscnet.ucla.edu/iaoe/eisp/. Thanks to EISP survey team members Matthew Bates; Gordon Hull; Debra Isaac; Susana Nahoe A.; Alana Perlin; Cristián Silva A., Johannes Van Tilburg, and Bill White. Additional field assistance was provided by Elena Mazuela H. and the Hucke family. The support of CONAF Park Guards stationed in Rano Raraku is deeply appreciated.

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