

The Study on Data Collection by GPS and Analysis on GIS in the Greater Lumbini

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Abstract: *Lumbini, the birthplace of Lord Buddha, is one of four Buddhist's major holy sites as well as World Heritage Sites. Tilaurakot, the archaeological remains of ancient Shakya Kingdom, Ramagrama, the only undisturbed original stupa of his relics, and other known/potential archaeological sites are in "the greater Lumbini". The UNESCO project, "Strengthening Conservation and Management of Lumbini", clarified "preservation and management of the World Heritage property of Lumbini can only be successful if the preservation and management challenges of the cultural landscape and sites that surround the property are addressed at the same time." Stretching out the scope to the Greater Lumbini, we try to identify and evaluate sub-surface archaeological sequences by mapping, carried out with the assistance from national survey institute and local archaeologists. The results not only have the potential to stimulate the site analysis but can also contribute to debates on the role of archaeology in the promotion of tourism and sustainable regional development. This paper will reference it by GPS and GIS in order to illustrate the benefits of utilizing the contribution of S&T to Culture Preservation.*

Keywords: Conservation Planning, GIS (Geographic Information System), GPS (Global Positioning System), Archaeological sites, Lumbini

1. INTRODUCTION

It is essential for planners to collect basic data and maps in order to conserve cultural heritage sites such as rich archaeological regions. They, however, tends to be too old or inadequate to use today. The focus of this paper is the practice of understanding the rich archaeological region by researching on site with GPS (Global Positioning System) and GIS (Geographic Information System) through the mission under UNESCO within the framework of the UNESCO/Japanese Funds-in-Trust Project for the Preservation of World Heritage, "Strengthening the Conservation and Management of Lumbini, the Birthplace of the Lord Buddha, World Heritage Property (Phase II)".

The paper consists with three chapters, methods for recording the region, results of how we understand it, and conclusion for the conservation planning. Finally, it argues that the results not only have the potential to stimulate the site analysis but can also contribute to debates on the role of archaeology in the promotion of tourism and sustainable regional development. This paper will reference it through Lumbini project by GPS and GIS in order to illustrate the benefits of utilizing the contribution of Science and Technology to Culture Preservation.

2. METHODOLOGY

Our mission from July 2014 to June 2015 will be to map heritage sites within Kapilvastu District and prepare specific

site catalogues for the Lumbini Development Trust (hereinafter, LDT) sites and other important sites consisting of following information with the assistance from the national survey institute and national archaeologists:

- a) Aerial photo and chronological map
- b) Boundary line of municipality/VDC
- c) Current control information by Ancient Monument Preservation Act
- d) Existing other land use and building control by laws/regulations
- e) Location of known/potential archaeological remains and its importance
- f) Archaeological importance
- g) Religious importance for pilgrims

We divide our method into three steps and demonstrate them in the following sections:

- STEP 1: Preparing the List of Research Sites
- STEP 2: Recording the Sites
- STEP 3: Mapping them and Creating Database

2.1 The 116 Site List from the 1997 Survey (STEP 1)

Firstly, we looked at the literature reviews, which demonstrated explorations in the Greater Lumbini region both by international and national archaeologists (Fuhrer, 1896; Mukherji, 1899; Mitra, 1972; Rijal, 1973; Mishra, 1977) (Table 1). Among them, we chose the latest exploration consisted with the largest numbers of sites in 1997 by the Italian team with local authorities (Verardi, 2007) (hereinafter Verardi's list).

They made the 116 archaeological site list with coordination. Following it with the local archaeologist, Mr.

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Basanta Bidari, former chief archaeologist at Archeological department of LDT, who joined the Italian team in 1997 and a national officer from Department of Archaeology (hereinafter, DoA), we also add the DoA sites as well as the sites that we happen to find to the list.

Table 1. The Chronological Exploration in the Greater Lumbini

Year	International and National Archaeologists (Nationality)
1896	Anton Fuhrer (German)
1899	Purna Chandra Mukherji (Indian)
1962	Debala Mitra (Indian)
1972	Baku Krishna Rijal (Nepalese)
1977	Tara Nanda Mishra (Nepalese)
1997	Giovanni Verardi (Italian)

2.2 Recording the Sites (STEP 2)

With the assistance from Himalayan College of Geometric Engineering & Land Resources Management, we recorded visible demarcation of each site by GPS (Global Positioning System) as well as its potential area. Also, we filled the form which requires the basic information, above-mentioned c), d), e), f) g), with the description of current condition and took photos on each site.

- Terms: 20 January 2015 to 10 February 2015
- Members: 3 (core) to 7 (occasional assistance)

2.3 Mapping and Database (STEP 3)

The output from the survey (step 2) developed on GIS (Global Positioning System) with up-dating the topographical data from the high-resolution images donated by Japan Aerospace Exploration Agency (JAXA). Using Microsoft Access software, we also developed the forms into the database (Fig. 1). Finally, combing these two, site catalogues will be published as the output of this mission.

Fig.1. Formats for the Database

3. RESULTS

As a result, we count 136 sites in total including one missing site, which was on Verardi’s list (Table 2). According to Mr. Basanta Bidari, the local archaeologist, most of them have been damaged or destroyed for firming by local people since 1997.

However, we could still recognize them by several indications. Some pieces of potsherds are noticed on the surface of most sites, which are a little elevated by the remains underneath in the flat landscape of *Tarai* region. Even though most sites are elevated, some sites are so prominent like a mound that some visible brickbats on their surface indicate that they have been intentionally shaped. Moreover, two fortified remains are clearly visible.

Regarding ownership of the sites under governmental custodianship, mostly the government purchased a part of them. Whilst the boundaries by ownership in some sites are fenced, mostly they are broken and used by local as their common ground. Utility poles or Hindu shrines or hay fields are on the fenced areas.

Fig. 2 showing the topographical analysis on a map, most of mounds are found in the southwest region where Tilaurakot, so-called capital city in the Greater Lumbini, is. Whilst we need to wait for future excavations so as to determine them as Stupas, it is one of outstanding analysis in order to understand the Greater Lumbini from landscapes. Fortifications found with some distances, we can imagine that the region must be divided into some territories. That will make people curious and promote more investigations by archaeologists as well as tourists, most of whom visit only to Lumbini World Heritage Site now.

Table 2. The List of Archaeological Site from the Survey

No.	Site Name	Custodianship	Ownership	Topography
1	Jungha	will DoA	Private	Flat
2	Koptaya			Flat
3	Tenua			Flat
4	Koptaiya	will DoA	Mix	Flat
5	Amauli	DoA	Private	Flat
6	Siuti			Flat
7	Kotiya			Flat
8	Kopawa N			Flat
9	Bikuli	DoA	Government	Flat
10	Gharabudhiya			Flat
11	Bhadasadawa	will DoA	Mix	Flat
12	Jagadishpur			Flat
13	Sagrahawa	LDT/DoA	Government	Mound
14	Chetiya			Flat
15	Banadhuli			Flat
16	Shrinagar			Flat
17	Katuwa			Flat
18	Jahadi			Flat
19	Karailiya			Flat
20	Galahi			Flat
21	Pipara			Flat
22	Niglihawa	LDT/DoA	Government	Flat/Ashoka Pillar
23	Shiwapura			Flat
24	Raksa Baba	DoA	Mix	Flat
25	Rudhaua			Flat
26	Thumuhawa			Mound
27	Araurakot	LDT/DoA	Government	Fortification

28	Barsauli			Flat
29	Rehara			Flat
30	Anarath	will DoA	Private	Flat
31	Tilaurakot	LDT/DoA	Government	Mound (Capital)
32	Belaspur			Flat
33	Semari			Flat
34	Bagadi			Flat
35	Chaudahawa			Flat
36	Sarkhuiya			Flat
37	Sadawa_village			Flat
38	Laksmingar			Flat
39	Patakahawa			Flat
40	Malpara			Flat
41	Manpur Bhusudi			Flat
42	Mahita			Flat
43	Siktahniya			Flat
44	Kankatawa			Flat
45	Piparhawa E			Flat
46	Gauriganj			Flat
47	Nawadihawa N			Flat
48	Kodahawa			Flat
49	Imiliya	will DoA	Mix	Flat
50	Bagawa			Flat
51	Nawadihawa S			Flat
52	Rajwapur	will DoA	Mix	Flat
53	Taulihawa	DoA	Government	Mound
54	Mehniya			Flat
55	Belbhariya			Flat
56	Madhunagar	could not find		-
57	Lausa			Flat
58	Dharampaniya	DoA	Mix	Flat/Historic Site
59	Dumara			Flat
60	Gaura	will DoA	Mix	Flat
61	Dohani S	DoA	Mix	Flat
62	Pipari	will DoA	Private	Flat
63	Bimiha			Flat
64	Gotihawa	LDT/DoA	Government	Mound/Ashoka Pillar
65	Kudan	LDT/DoA	Government	Mound
66	Sheharaiya			Flat
67	Bhagawapur			Flat
68	Sauraha			Flat
69	Lamtiya	will DoA	Private	Flat
70	Kodaradih			Flat
71	Sishaniya Thulo	will DoA	Mix	Mound
72	Daldalha	DoA	Mix	Flat
73	Kunwa Gaun			Flat
74	Karma	will DoA	Mix	Fortification
75	Hardewa	DoA	Mix	Mound
76	Mungehari	will DoA	Mix	Flat
77	Kapasi			Flat
78	Vadehar			Mound
79	Dangari			Flat
80	Baskhor W			Flat
81	Gulari			Flat
82	Shrirampur			Flat
83	Bankasiya			Flat
84	Abhirawa			Flat
85	Baskhor E			Flat
86	Babhni	DoA	Mix	Flat
87	Mahadewa	DoA	Mix	Mound
88	Amarlonaha			Flat
89	Budhapar			Flat
90	Sultanwanpur			Flat
91	Ramnagar			Flat
92	Bedauli S			Flat
93	Bahadilawa W			Flat
94	Bahadilawa E			Flat
95	Bijuwa	DoA	Mix	Flat
96	Murphutawa			Flat
97	Sishaniya	LDT/DoA	Government	Flat
98	Parsohiya			Flat
99	Ramawapur_Rajuwapur	will DoA	Mix	Flat
100	Kopuwa			Flat
101	Sisawa			Flat
102	Shankarpur			Flat
103	Bhaisadiya			Flat

	104	Somdih			Flat
	105	Madhanagar			Flat
	106	Mudila			Flat
	107	Pipara	will DoA	Mix	Flat
	108	Chakal Chauda			Flat
	109	Nandanagar S			Flat
	110	Kadjhawa			Flat
	111	Barkul	will DoA	Private	Flat
	112	Galbariya			Flat
	113	Jayanagara			Flat
	114	Purnihawa			Flat
	115	Shiwalwa	will DoA	Mix	Mound
	116	Dohani			Flat
added	117	Sadawa canal			Flat
	118	Gobari			Flat
	119	Bargadawa			Flat
DoA List (except above 'DoA' and 'will DoA')	120	Dharampaniya shivalaya			Flat
	121	Athkoniya	DoA	Private	Flat/Well
	122	Baluhawa	DoA	Mix	Mound
	123	Ganshpur Stupa	will DoA	Mix	Mound
	124	Beloha	will DoA	Private	Flat/Well
	125	Chetaradehi	DoA	Mix	Mound
	126	Darewa	DoA	Private	Flat
	127	Tauleshwornath	will DoA	Mix	Mound
	128	Thulo Bargadawa	will DoA	Private	Mound
	129	Siddhipur			Flat
	130	Ramapur Stupa	will DoA	Mix	Flat
	131	Dhamanihawa Stupa	DoA	Mix	Mound
	132	Kanthak Stupa	DoA	Mix	Mound
133	Reharawa Stupa	DoA	Mix	Mound	
134	Kopawa	will DoA	Mix	Mound	
135	Bardahawa	DoA	Mix	Mound	
added	136	Hastigrata		Mix	Mound

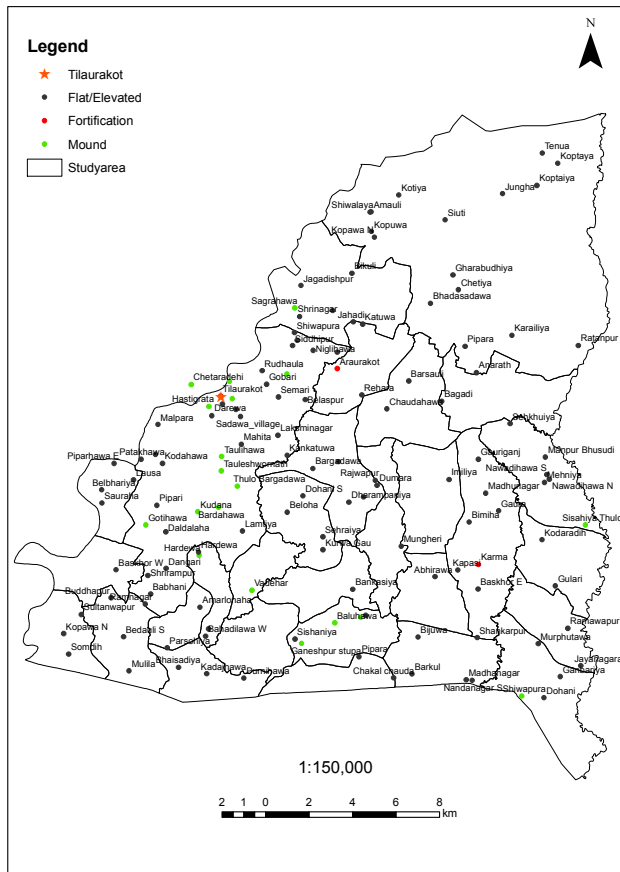


Fig.2. Overall Map by Topographical Analysis

4. CONCLUSIONS

Referencing the UNESCO Lumbini project by GPS and GIS, the paper illustrated the benefits of utilizing the contribution of Science and Technology to Culture Preservation. As it demonstrated the methods and results, we conclude that the results not only have the potential to stimulate the site analysis but can also contribute to debates on the role of archaeology in the promotion of tourism and sustainable regional development, which should be the base for conservation planning in the Greater Lumbini.

Further, we plan to analyze the region more by remains and other perspectives on a map and collaborate with the archaeological team from Durham University so as to proceed the Greater Lumbini on the right track.

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