SUNDASIA FIELD REPORT

(17th March – 6th April 2017)

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1. Summary

This season of work (the third) on the SUNDASIA Project comprised two main components. The first was a two-day project workshop (18th and 19th March) at which members presented progress reports on their individual work packages, and challenges and opportunities (such as in the area of biodiversity) were discussed with Vietnamese colleagues and invited experts. The second component of work was a fieldwork period from 20th March – 6th April. This involved archaeological excavations at Thung Binh 1, where a single 2 x 2 m trench was opened and the cultural evidence uncovered that will advance understanding of prehistoric peoples during the last 5-7000 years. This was a period of significant local environmental changes and the record from Thung Binh 1 should provide detailed insight into how ancient people coped with those changes. In addition to excavation, a topographic survey and cave assessment programme was also undertaken. During 11 field days, 26 cave sites were visited and catalogued with the aim to extend and augment previous studies. As a result of this work 11 new caves were added to the Tràng An database, with one site – Hang Trau Bai Dinh – offering good archaeological potential for future investigation. Linked to both parts of the fieldwork was a third element: the collection of samples of land snail and riverine shells both from the excavation at Thung Binh 1 and from several of the locales visited in the topographic survey. The aim of this sampling programme is to assess the chemical composition of shell from different areas, altitudes and of different antiquity within the Tràng An massif, with the objective of creating a reliable new way of dating archaeological sites. Both the workshop and the fieldwork elements relate directly to the central objectives of the SUNDASIA Project and lay important foundations for further work later this year, as well as forthcoming results from laboratory analysis.

2. Project Workshop

The AHRC (Arts and Humanities Research Council) grant that funds the larger part of the SUNDASIA Project contained within it provision for two project workshops: in March-April 2017 and April-May 2018, as well as part funding towards the cost of a larger international conference in 2019. The managerial aim of the two workshops, as stated in the grant application, was for all members and key collaborators (*c*.30 people) to meet in a semi-formal setting where team members would present and discuss initial progress, objectives and potential challenges. The first of the workshops was to be held in Vietnam.

A total of 26 delegates attended the project's first workshop, which was held at the Bai Dinh Hotel, Ninh Binh (18th and 19th March), and hosted jointly by the Tràng An Management Board and the Ninh People's Committee. Eight presentations were made in the following areas:

- Project background
- Geology of the Tràng An massif
- GIS and terrain-mapping in Tràng An
- Ancient shorelines
- Shell isotopic analysis and radiocarbon dating programme
- The Hoabinhian
- Tropical forager subsistence – faunal and human remains
- Palaeoenvironmental reconstruction

2.1 Issues and Opportunities

Although this was an important opportunity for team members and key stakeholders to meet and discuss the project, it ran the risk of becoming too self-affirming. To counter this, a panel of external experts was invited to attend, to chair sessions and ultimately to offer the project management constructive criticism as well as encouragement. This added element to proceedings often drove discussion and highlighted a number of issues for the project to examine as well as some exciting opportunities we had not foreseen. For example:

1. The value of local participatory work in landscape data collection;
2. The possibility of accessing open-air archaeological sites;
3. The inclusion of conservation into GIS database creation (consistency and language transferability of search terms);
4. Conservation management on site and within an archival facility;
5. 'Wiggle-matching' age-depth modelling in shell dating;
6. Human adaptive record at *c*. 7000 years ago, during the proposed period of enhanced monsoon;
7. Examine how biodiversity ties into human adaptive challenges;
8. Ensure that project goals are propagated through each of the work packages, so each has a clear sense of same set of goals.

2.2 Media coverage

The workshop was covered by several local and national media outlets including Vietnam Television 1, the flagship national news station of Vietnam. Dr Rabett, Dr Coward, and Dr Van provided interviews about the project, which were featured in a ~20-minute special. Dr Rabett provided a workshop summary on our project website, which will be disseminated via our own Facebook page (https://www.facebook.com/sundasia/) and Twitter account

(https://twitter.com/SUNDASIAProject) as well as the Smithsonian's Human Origins Program social media outlets (https://www.facebook.com/smithsonian.humanorigins/, https://twitter.com/HumanOrigins).

2.3 Outcomes

Among several positive outcomes from the workshop, important steps were made in the area of monitoring and conserving extant biodiversity in the Trang An project area. Mr Hardcastle (IUCN) was very optimistic towards our efforts in characterizing biodiversity, and provided us with a contact at Cúc Phương. Dr Rabett, Dr Stimpson, and Ms Tran (Long An Provincial Museum, Senckenberg Research Institute) visited the park on 5th April, and had a productive meeting with park management. A particularly encouraging result of the visit was the potential for sharing advice and expertise with staff at Cúc Phương with reference to biodiversity monitoring in Tràng An. Furthermore, a visit to the Endangered Primate Centre yielded a valuable outcome as there may be a potential source of reference material that will aid in the identification of primate bones recovered during the project's excavations. This is especially pertinent given in-principal proposals for the (re)introduction of the rare Delacour's langur (*Trachypithecus delacouri*) to Tràng An. These relationships should prove fruitful to our efforts in characterizing the complex relationship between humans and their natural environment throughout time. In addition to existing contributions to biodiversity monitoring within Tràng An (invertebrate surveys, small vertebrate monitoring), the SUNDASIA project has proposed a campaign of static camera monitoring in the park, with a view to further exploring, in a preliminary way, the extant diversity of larger mammals in the massif. The project plans to action this proposal in September 2017.

Drs Coward and Kahlert provided a review of imaging strategies at Tràng An. After hearing this presentation, Drs Van and Trung (VIGMR) helped to further facilitate the work and Dr Kahlert also met with members of the Vietnam Institute of Geodesy and Cartography (VIGAC) in Ha Noi after the workshop (29th March), which also proved to be very productive (see below). Another discussion at the workshop related to future possibilities in imaging. Drone imaging of the park will be looked into, and parties responsible for permissions will be contacted.

A further outcome of the workshop was an increased emphasis on curation of artefacts. Mr Cleere (ICOMOS) provided the project with a good review of the resources involved in managing cultural heritage. One of the most important points that Mr Cleere made concerned accessibility for Vietnamese researchers. It is imperative that our artefact database is bilingual (Vietnamese and English) so that all researchers have easy access to excavated material.

The workshop also provided us with constructive feedback in approaching public outreach at Tràng An. It is important to consider cultural differences in making our research accessible to the public. What may work in western contexts may not work at Tràng An. In order to derive an optimal outreach framework, we will work with local experts (Ms Tran included). As stated in Mr Utting's presentation, it is important to start small and adapt as needed in any case. Prof Marwick (University of Washington) offered a further suggestion that we offer to conduct a seminar at a university in Ha Noi. While efforts have been made in the past, we will continue in pursue this avenue and extending communication. To this end plans are being formulated with the Trang An Management Board for a presentation to local people (in a community centre venue) about the project and its goals for this coming September.

3. Excavation field season: Thung Binh 1

Owing to unpredictable and often wetter weather conditions at this time of year, the project team arrived with three different field options for the period 20th March to 6th April. If the weather looked set to be fair we would target further excavations at Hang Hanh; if not we would focus on cave work where there was less exposure to the elements, either inside the park at Hang Moi, or close to the Bai Dinh Hotel at Thung Binh 1 (TB1). In the event, we decided to at least begin by focusing on the last of these options. TB1 had the added benefits of being a known quantity – i.e. it had been surveyed by the Institute of Archaeology in 2008 and excavated (a 2 x 2 m trench) in 2012 with positive results; it provided the project with a record from the opposite margin of the massif to Hang Hanh, thus broadening our landscape coverage; and it had been one of the sites on which we had used ground-penetrating radar (GPR) in September 2016. Access to the site was relatively easy, though did involve a short scramble up a relatively steep (and as we found, after rain very slippery) slope. A rope was installed on the second day of the excavation to assist with access.

Upon arrival on site on 20th March we decided instead to explore the deposits in the smaller adjoining chamber to the main cave. Headroom was limited, but equally well-illuminated with natural light. Both chambers were surveyed using the automatic level, laser distance measure and line off-sets to establish a basic plan of the site. A 1 x 1 m grid system was then established within which we would situated our trench, which we staked-out perpendicular to the cave wall, extending out 2 m towards the cave lip (1 x 1 m grid squares 150/250 and 151/250). Ultimately, we excavated a 2m x 2m trench in plan (and therefore incorporated four 1 x 1 m grid squares: 150/250, 151/250, 150/251 and 151/251) to a maximum depth of *c*. 70 cm.

The surface and initial subsurface contexts (C800-C802; maximum depth below surface *c*. 35 cm) were excavated with a regime of dry-sieving (2 mm mesh) 1 in every 4 buckets. Even in the second context (C802), cyclophorid and riverine shells (typical of the midden uncovered by the Institute in the main chamber and of other sites) began to appear in increasing frequency within a deposit that shifted variably between densely compact (possibly trampled) and more friable layers. Some reddening of the sediment and charcoal in 151/250 hinted at the possibility of localised burning in this square. At contact with this sediment change there was a significantly higher frequency of micro-vert remains (e.g. rodent, frog, snake) + one or two pieces of crab in 151/250. There is a reasonable possibility that these are the result of a roosting owl (many of the frags exhibit evidence of digestive corrosion).

In 151/250 context (C802) was found to contain a burnt lens (C803; maximum thickness *c*. 5 cm). This proved to be quite ephemeral, though with a high frequency of charcoal, and was removed as a single bulk sample of sediment for post-excavation processing. In 150/250 (C802) continued down uninterrupted, though the generally higher frequency of shell and bone from this square hinted at the possibility that food waste was being deliberately dumped against the back wall of the cave.

A change in context occurred across both squares to a much denser concentration of shell, mirroring (though not necessarily contemporary with) the density of shell midden seen in the Institute's trench in the main chamber. This became our context (C804; c. 30-70 cm below the surface). At the interface between (C802) and (C804) the first of what would be three distinctive Da But corded ware pottery sherds was recovered. Every bucket from (C804) was sieved. The texture of sediment from this context was more friable than (C802), with frequent cyclophorid and moderately frequent river gastropods making up the shell midden. The context also contained angular to sub-angular limestone fragments and

moderately frequent animal bones, including now from large mammals, fish and chelonids (costal and plastron frags), but comparatively little charcoal. After the first 10 cm of excavation within noticeable change in the deposit, we switched to spit digging across both squares to ensure controlled recovery within what appeared was going to be a thicker comparatively uniform context.

Aside from the three fragments of pottery, artefact evidence was sparing (see technological summary below), with minimal numbers of potentially struck stone flakes and one piece of modified shell: a perforated neritid shell from the base of spit 2 in 151/250. In spit 3 the midden deposits were densely compacted, with very frequent river gastropods, moderately frequent cyclophorids and infrequent razor shells and mussel fragments. Charcoal continued to be a rarity. Crab was also very rare – two notable differences to otherwise apparently similar deposits from Hang Boi. An apparent emphasis on river resources, including the turtle (carapace and post-cranial) and fish remains continued to be identified from this spit. The final part of (C804) spit 3 was removed during the morning of 28th March. As per usual procedure between contexts and spits, the trench sections were cleaned back, a trench plan was drawn up with key features (rocks), photos and levels were taken.

On the 28th we extended our initial trench into a 2 x 2 m. This would increase what had been a good but comparatively small sample of material from the 2 x 1 m, and improve ease of access to deeper deposits (leaning into the base of the trench from the trench edge had by this point become quite difficult). We therefore opened the adjoining (to the north) squares: 150/251 and 151/251, following the same sieving and sampling protocols we had adopted for the first squares.

Contact was made with (C803) – the charcoal and ash deposit in 151/251 – on 30th March, with some lumps of charcoal again already starting to appear in the basal part of the overlying (C802) in this square. The full extent of the area of burnt material was now revealed and found to be quite limited. As previously, the context was lifted as a single bulk sample <W1835> to maximise recovery through flotation, but the context was only about 2 cm thick and there appeared to be little in the way of burnt sediment underlying it (though some apparently burnt fragments of limestone – red/black).

At the interface between (C802) and (C804) – the shell midden deposits – we started to sieve every bucket. This was slightly earlier than in 150/250, but mindful of the recovery of Da But sherds at this point in those first squares. There was an increasingly frequency of riverine gastropods, but no further ceramics. The sediment was still quite compacted in areas of the trench, especially 151/251.

Context (C804) spit 1 immediately saw an increase in the frequency of cyclophorids, we also once again started to pull out larger pieces of bone – including almost certainly from a species of large deer – as well as fish spines and vertebrae, occasional turtle carapace fragments, and very infrequent small crab claws. Whereas we had been taking bulk sediment samples (for flotation) and (whole) shell recovery from square 151/250 in the trench, in the extension squares we collected these from 150/251 to ensure both sides of the trench were covered (bearing in mind the observed differences in material concentration between them). A small cowrie-like shell fragment was found at the sieves from 151/251 (C804) spit 1 (possibly worked/pigmented).

It is notable that the large mammal bone we were finding was frequently extremities, including phalanges and metapodials (often unfused, and often fragmented), though fragments of long bone were also found as well as ungulate teeth (possibly deer). Burnt bone was quite frequent, but charcoal remained much less so either in the trench or at the sieves. A left and right porcupine mandible with intact tooth rows from a small specimen – possibly

Atherurus sp. – was recovered from 150/251 (C804) spit 2. The same spit in this square also yielded another intact mandible with tooth row from the NE corner. Assigned Small Find number 5, this was from a larger specimen, probably *Hysterix* sp. A definite softshell turtle costal fragment came from sieving 151/251 (C804) spit 2.

Highly concreted shell midden deposit with infrequent weathered and eroded bone was gradually revealed in the NW corner of square 150/251. After some initial uncertainly, it became apparent that this was attached to the cave wall. It is unclear if this was from an earlier/separate occupational period or if it is simply part of the midden we are excavating that has become cemented to the wall here because of water percolation and calcium carbonate precipitation. (Note that a sample of this material was taken for future analysis.)

Context (C804) spit 3 151/251 produced a moderate frequency of large mammal (and occasionally reptile) bone until the basal part of the spit, at which point it became appreciably less frequent; conversely charcoal recovery increased marginally, and two pieces that were of sufficient size to warrant 3D planning from near the base of the spit in 151/251: <W1848> and <W1849>. On the final day of digging (2nd April) the remainder of (C804) spit 3 in square 150/251 was excavated, including one last large piece of charcoal <W1850> for which we again took full details of depth and location in the trench. This was a comparatively large sample (a cyclophorid in association) and probably our first choice for dating the lower part of this sequence. It is worth reiterating that all of these larger charcoal samples recovered in spit 3 of the extension came from near to the base of the 10 cm spit.

Once (C804) spit 3 was completed in both squares, and the surface of spit 4 planned, levelled and photographed, digging continued in 150-151/251, as these seemed more readily excavated. Initially, the sediment remained compact silty clay and continued to contain frequent cyclophorid and riverine shell, as well as large mammal bone fragments (including burnt bone) from each square. Stone flakes with apparent platforms had started to appear in spit 3 (*see* bag 111.3), and two others were collected at the sieves in spit 4 (*see* bags 112.4 and 113.3). As excavation continued, however, the sediment in both squares became more compact and distinctly more clay-dominated. The frequency of bone (including some more weathered pieces) began to drop first before the frequency of shells dropped precipitously appreciably, such that by 5-6 cm through this spit, rocks and extremely compact deposits were predominant in 151/251. Deeper excavation would require picks. At this point the excavation was closed and (on the morning of 3rd April) the trench was lined with a semi-permeable sheet and backfilled to three-quarters full using sediment and shells from the excavation spoil heap.

3.1 Preliminary interpretation

Deposits excavated in the small chamber of Thung Binh 1 appear to have had occasional use in the recent past, perhaps with goat activity featuring as the source of likely trampling of deposits. There are indications that the chamber was used as a roosting site, perhaps for an owl, as attested by the range of often partially digested microfaunal remains at the interface between (C802) and (C803). A small fire was lit here, the remains of which spanned squares 151/250 and 151/251. Food refuse, which may or may not have been associated with this fire, was piled preferentially against the cave wall. The main shell midden, however, marked a significant change in context beneath this in all four squares. The interface between (C802) and (C804) produced the three fragments of Da But ceramic and by implication one assumes a Neolithic horizon.

Recovery of a perforated neritid (a marine) shell from (C804) spit 2 150/251 was potentially significant as a marker of the age of this part of the depositional sequence. As we have previously recovered perforated neritids from both Hang Boi and Hang Trong in pre-

Neolithic deposits, recovery of such an artefact at this depth of excavation at TB1 lends some suggestion that the midden here may also be pre-Neolithic in age, very provisionally mid-Holocene or slightly earlier (perhaps 5-7000 years ago). The midden contents remain to be examined in detail, but included a range of faunal taxa from terrestrial and riverine (and estuarine) habitats. The increasing clay component within (C804) spit 4 was reminiscent of what we had previously seen during our excavation of the Hang Boi shell midden towards its base. The decline in bone and especially shell frequency at Thung Binh 1 within this spit, combined with this noticeable change in deposit (and were we to continue, context also), suggests that our excavation reached the base (or close to it) of this midden. Radiocarbon dates will be obtained, but if the projected age range is broadly correct, this site will offer new insight into subsistence practice during or immediately after the likely period of the enhanced monsoon ending *c*. 7000 years ago (see item 6 of 'issues and opportunities' above).

3.2 Tràng An Management Board: staff training

An important part of the SUNDASIA Project's work in Tràng An is a commitment to help provide on-site training in archaeological excavation and post-excavation processing. During the course of the field season covered by this report four members of the Tràng An Management Board worked alongside the SUNDASIA archaeological team. Le Thi Thanh Kim Hue, Vu Thi Lien and Nguyen Thi Loan worked in rotation at Thung Binh 1 or on the landscape survey portion of the season (see below). Vu Duy Linh worked almost every day at the cave. Mr Linh led cave logistics and developed his skills in excavation, site and trench planning techniques, as well as on-site processing and finds sorting. Le Thi Thanh Kim Hue and Nguyen Thi Loan, like Vu Duy Linh, have worked with the project during previous field seasons. Vu Thi Lien, however, joined the cave excavation team from 28th March for the first time. Despite no previous experience of archaeology she familiarised herself rapidly with site procedure and was quickly volunteering to dig as well as work the sieves – becoming proficient at both aspects of work by the end of the season, and confident enough to check and ask other team members if she had any queries. On-training represents only one skill-set within cultural heritage management, and experience is gained and built upon over a time, but the enthusiasm, professionalism and good humour of the Management Board staff working with us this season, as it has previously, signals a strong appreciation of its importance.

4. Topographical survey and cave assessment

A survey of Tràng An caves and sea notches was carried out in the north and west of Tràng An. Topographic surveys and assessments were conducted 11 field days between March 21st and April 3rd 2017 during which 26 cave sites were visited (Table 1). 11 formerly unrecorded caves were added to the Tràng An cave database and four are recommended for removal.

<u>Survey team:</u>
Thorsten Kahlert
Pham Sinh Khanh
Le Thi Thanh Kim Hue
Vu Duy Linh
Nguyen Thi Loan

<u>Xuan Truong Construction Company surveyors:</u>
Tran Le Van Minh
Nguyen Van Lam (Trong)

4.1 Objectives:

1. Assessment of recorded caves for which no further information exists;
2. Exploration of areas within the park and buffer zone that were not covered by the VIGMR and Laumanns' surveys;
3. Survey of recorded (VIGMR) and unrecorded sea notches;
4. Survey trenches and TBM from previous and current excavations at Hang Thung; Binh, Hang Hanh and Hang An Noi;
5. Create a 3D model of Thung Binh 1.

4.2 Additional activities:

6. Meetings at the Vietnam Institute of Geodesy and Cartography (VIGAC) and VIGMR;
7. Public outreach and local engagement.

4.3 Assessment of recorded caves for which no further information exists

From over 100 recorded caves, based on Laumanns 2014 publication along with further literature available in English, a subset of 29 caves was selected for field investigation. Those caves are a) known or suspected to be inactive and b) are not further described apart from a general mention in the literature. Water caves were principally omitted from the survey. Apart from collecting some basic data on the caves, the GPS locations are also going to be used to ground truth the location data provided by VIGMR and Michael Laumanns. The survey started in the northern section, near the Bai Dinh hotel and progressed southwards over 11 field days. Fifteen locations were visited, 10 of which were verified as cave sites. Five caves could not be located, nor was there any local knowledge about the presence of a cave. Preliminary processing of GPS data indicates that provided location data can vary anywhere from 6 m to 135 m against measured locations.

One cave, Hang Trau Bai Dinh, showed good archaeological potential. The cave is located *c*. 3.3 km northwest of the Bai Dinh Hotel at the edge of the buffer zone. It penetrates the southern base of a low limestone hill and features two spacious entrances. The single chamber measures 7 m by 6.5 m and is 6 m high. The floor is flat, dry and consists of compacted sediments covered by a thin layer of loose soil. The sediments extend at least 30 cm below the surface with the upper 15 cm producing glazed pottery and stone ware.

Point_ID	Easting_Lo	Northing_L	Status	archaeological potential	finds	Date_Time
HANG LUON BD			located but not recorded	Cave visible as small entrance near top of steep limestone hillock, inaccessible at the time of visit. Not expected to be of archaeological potential due to location and size of entrance		03/25/2017
HANG TIEN	105.90606	20.29015	located but not recorded	very small chamber, not a true cave		03/31/2017

Point_ID	Easting_Lo	Northing_L	Status	archaeological potential	finds	Date_Time
THUNG BINH 1	105.86474	20.26162	location added	excavated, archaeological		03/20/2017
THUNG BINH 2	105.8646	20.26104	location added	excavated, archaeological		03/21/2017
THUNG BINH 3	105.86461	20.26084	location added	excavated, archaeological		03/21/2017
THUNG BINH 4	105.86461	20.26067	location added	excavated, archaeological		03/21/2017
HANG CAN	105.87757	20.27237	location verified	none, converted for farm use		03/23/2017
HANG TROI	105.87749	20.29097	location verified	none, concrete floor, used for offerings		03/23/2017
HANG TRAU	105.87858	20.28361	location verified	ex water cave, possibly prone to frequent flooding. Very low potential		03/24/2017
HANG TRAU BAI DINH	105.84903	20.30165	location verified	at least 30cm sediments (possibly much more), surface and buried historical archaeological material	2 bags, pottery, shells	03/25/2017
HANG MUOI	105.90853	20.27526	location verified	none, modified		03/25/2017
HANG BIN	105.89149	20.27514	location verified	low potential. Possibly ex-water cave and modified for farm use		03/31/2017
HANG BIN	105.89149	20.27514	location verified	none, modified for farm use. Through cave, probably ex water cave		03/31/2017
HANG DIA	105.90606	20.29015	location verified	none, temple Cave		03/31/2017
HANG BA CHUA	105.89344	20.28988	New site	none, modified		04/02/2017
THUNG BINH 0	105.86483	20.26204	New site	deposits present in some areas		03/24/2017
ROCK SHELTER 1	105.87313	20.29683	New site	sediments present but close to water table		03/23/2017
ROCK SHELTER 2	105.87317	20.29728	New site	sediments present but close to water table		03/23/2017
HANG KIEN	105.87555	20.28355	New site	few sediments, low potential		03/24/2017
HANG THOR	105.8756	20.28357	New site	sediments, some	1 bag,	03/24/2017

Point_ID	Easting_Lo	Northing_L	Status	archaeological potential	finds	Date_Time
				surface finds	pottery	
HANG BAT DUA	105.87256	20.25017	New site	at least 30cm sediments (possibly much more), surface and buried historical archaeological material	3 bags, pottery, bones, lithic	03/28/2017
HANG QUEN THUNG CHUA	105.87162	20.25036	New site	Thick sediments, surface pottery finds (historic)	1 bag, pottery	03/28/2017
HANG DA TRANG	105.86965	20.23744	New site	some sediments present, surface finds (historic pottery)	1 bag, crab	03/28/2017
HANG DOI	105.87305	20.24753	New site	thick sediments, surface pottery finds (historic)	2 bags, pottery, bones	03/30/2017
HANG ONG NOI	105.87125	20.25151	New site	sediments present, some surface finds (historic pottery)	1 bag, pottery	03/30/2017
HANG CAU DEN			No cave present at location			03/23/2017
HANG CHUA BACH			No cave present at location			03/24/2017
DONG SUA			No cave present at location			03/24/2017
HANG DUC			No cave present at location			03/23/2017
HANG DOI BE			No direct GPS location taken, however, cave is 10m north of Hang Doi	no significant level of sediments present		03/30/2017
HANG VONG			Water cave			03/24/2017

Table 1: List of caves visited during the topographic survey (March/April 2017).

4.4 Exploration of areas within the park and buffer zone that were not covered by the VIGMR and Laumanns surveys

Twelve formerly unrecorded caves were discovered on route to recorded caves as well as through targeted exploration. The west and southwest are the least explored areas of the Trang An park evident in a distinct paucity of caves as well as sea notch sites. The area consists of steep karst towers and dense limestone forest and it presents itself as the most promising part of the park for new discoveries. However, trackways leading into the area

are sparse which makes it is also difficult to access. This season we exploited the outer fringe of western protected zone where some level of road access is available and where possible tracks were detected in aerial photographs. With the help of locals, namely Mr. Binh, Mr. Hung and Mr Hung, six caves were discovered.

Hang Bat Dua (Cave of the broken pots) can be reached via a short walk down a track between field and through a short stretch of light undergrowth. A short climb over some large limestone boulders and through thick vegetation. The cave is at *c.* 46 m asl, faces north and consists of a short passage leading into small 5 by 6m chamber which is decorated with several large speleothems. The floor is covered with a large quantity of sherds of glazed pottery and stone ware. Deposits inside the chamber are made up of loose sediments overlaying compact alluvial material. Bone fragments and gastropods shells were also recovered.

On March 23rd, whilst searching for caves on the opposite side of the mountain in which Hang Bat Dua is located a local farmer, Mr Huy donated a socketed stone axe which he claimed to have retrieved from Hang Bat Dua.

Hang Quen Thung is located 100 m west of Hang Bat Dua at an elevation of *c*. 60 m asl. It can be reached by following an ancient track that crosses a saddle into a neighbouring doline. The cave consists of a sheltered overhang that leads into an upper and lower chamber. The upper chamber remains unexplored. The lower chamber is slightly below the ground surface and measures 4 by 5 m. The chamber floor consists of loose sediments that cover compact alluvium. A 20 by 20 cm sondage was dug in the north of the chamber to a depth of 30cm but did not produce any archaeological material below the top 5 cm.

Hang Doi was, apart from Thung Binh 0, the most extensive cave of the newly explored caves. It is located in an isolated doline and can be reached by walking the same track along which Hang Quen Thung is located. A short climb up a steep slope leads to a wide and low cave entrance. The cave consists of six chambers that are connected via short rift passages. Three of the chambers are accessible via a tight squeeze. A small bat colony (c. 20-30 individuals) occupy this section of the cave. Cockroaches, water beetles and cave centipedes were also noted. Animal tracks, possibly belonging to a carnivorous mammal were found in furthest of the six chambers. Large speleothems decorate almost all parts of the cave.

Few pottery were found distributed throughout the cave. A sondage measuring 10 by 10 cm was excavated to a depth of *c*. 30 cm. The soil was compact with increasing depth it became increasingly more difficult to loosen. The upper 10cm produced glazed pottery sherds and bone fragments.

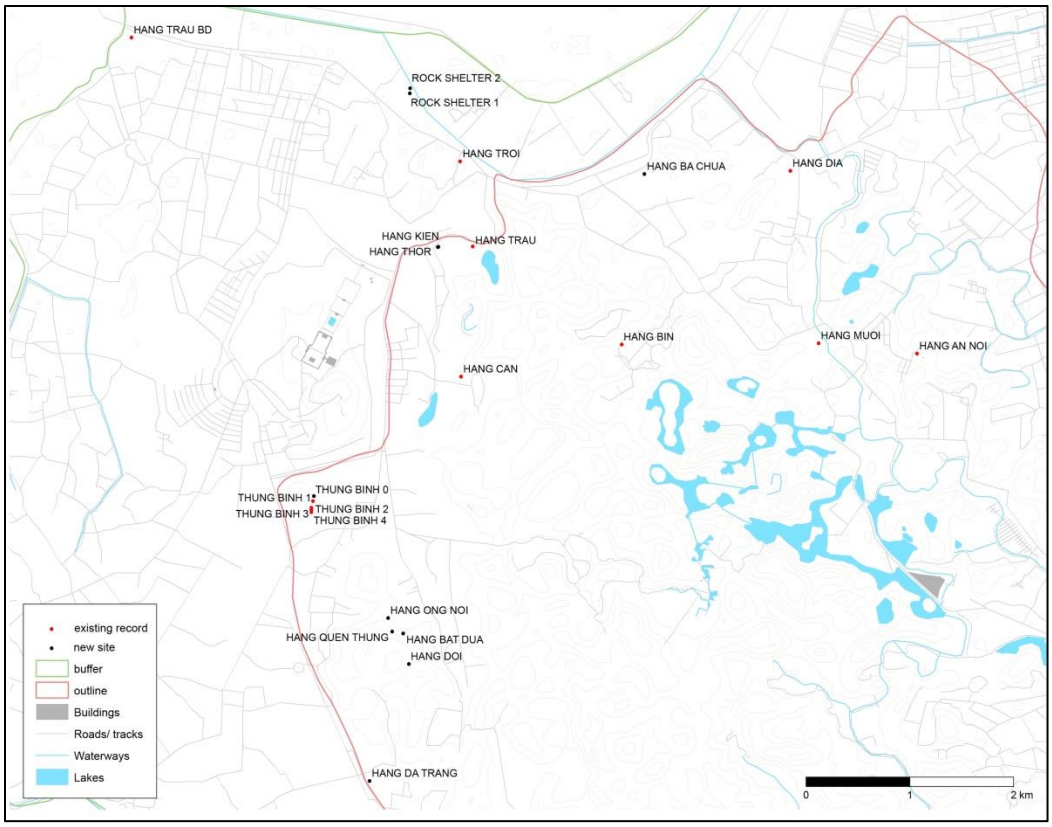
4.5 Survey of recorded (VIGMR) and unrecorded sea notches

Sea notches were recorded at three locations using a compass and laser distance meter offset measurement from the GPS unit. One site was recorded in a karst tower remnant 2.5 km north of the Bai Dinh Hotel. The tower also hosts two rockshelter sites that were also recorded but due to their low altitude and close proximity to the Song Hoang Long River the sites showed little potential for the presence of archaeological remains. Two further sea notches were recorded at Hang Muoi and Hang Bin.

4.6 Survey trenches and TBM from previous and current excavations at Hang Thung Binh, Hang Hanh and Hang An Noi

Excavation trenches at Hang Thung Binh, Hang Hanh and Hang An Noi were recorded with the help of a team from the Xuan Truong Construction Company, which was led by Mr

Minh who was assisted by Mr Lam and Mr Bang. All ites were staked out using dGPS and the total station was setup within an average error of 15 cm. Trench corners and TBMs were recorded and transferred as raw and xyz files.



Sites visited during the March 2017 season.

4.7 Create a 3D model of Thung Binh 1

1100 photos were taken to record both chambers at Thung Binh 1. Initial renders of a section of the cave showed good results with sub-cm accuracy. Further renders are currently under way.

4.8. Meetings at the Vietnam Institute of Geodesy (VIGAC) and Cartography and VIGMR

A meeting was set for March 29th with Dr. Pham Minh Hai, Vice Director of the Vetnam Institute for Geodesy and Cartography at their premises in Hanoi. In attendance were also Nguyen Cong Son, Deputy Head of Science Technology and International Cooperation and a GNSS technician.

4.8.1 Outcomes:

1. RTK network is in place in Trang and access can be provided by the institute
2. Technical support and equipment can be provided by VIGAC
3. In lieu of a high resolution DEM for Trang An, Dr. Hai suggested the use of a fixed wing drone to generate such model. The institute has successfully created DEM for pipeline and other large scale landscape projects
4. Costs for service and equipment on rental basis but I hope that we can establish a formal research collaboration based on exchange of knowledge and publicity
5. The institute offered to provide benchmark location data for our current survey

6. Further talks about research collaboration were agreed on with the prospect of a visit to Trang An by a VIGAC delegation during next season

During my brief meeting with Dr Trung at the VIGMR we discussed my meeting with Dr Hai at the VIGAC the current progress of my survey efforts and data Dr Trung sent to me following the December season.

4.8.2 Outcomes:

1. 0.5m DEM data only exists for select areas within the park;
2. Dr Trung welcomed the prospect of a drone-based 3D scan of Tràng An;
3. Dr Trung confirmed that the west of the park was not surveyed by VIGMR but explained that there is scope for the discovery of caves and sea notches within that area;
4. Dr Trung will receive the locations of all re-surveyed and newly surveyed sites.

4.9 Public outreach and local engagement

Public outreach and local engagement was conducted on two levels. During our search for caves we approached locals and explained to them what we were doing and if they would be willing to share their knowledge of any caves with us. We were met almost exclusively with great enthusiasm and those who knew of locations were eager to lead us to caves, often abandoning their own work for several hours. Occasionally these small excursions were followed by socialising over tea and offers to inform us should anyone learn about the presence of further caves in the area.

The SUNDASIA Facebook page was launched as an outreach tool in addition to the project website and twitter. It features updates on our progress, coverage of the workshop and links to articles authored by our team members and collaborators. Furthermore, it seeks to illustrate not only the good work relationship with our Vietnamese colleagues but the personal friendships that have formed over the past 10 years.

4.10 Recommendations:

1. Update the cave registry at VIGMR with the new data collected during the March 2017 season, including the addition of 11 new sites and removal of 4;
2. Hang Trau Bai Dinh, Hang Bat Dua, Hang Quen Thung and Hang Doi showed sufficient levels of sediments to warrant test excavations to further assess their archaeological potential. The easily accessed and comparatively spacious Hang Trau Bai Dinh may also allow for geophysiocal surveys to search for potential features;
3. Establish a formal collaboration with VIGAC and seek provision of survey equipment (RTK GNSS systems and total station) for future survey seasons;
4. Create a drone based photogrammetric 3D model of Trang An in collaboration with VIGAC;
5. Further build on local communities to find more caves, specifically in the western part of the park.

5. Cultural material – stone tools

2017 excavations at Thung Binh 1 yielded very few lithics: consisting of infrequent small fragments presenting a defined bulb of percussion. More recent contexts yielded limestone shatter that was presumed to be a result of goat trampling. One of the future investigations for the stone tool doctoral research package will be to examine the effect of goat trampling

on limestone. This should prove fruitful in determining specific breakage patterns in trampled material and diagnosing 'false positives' in lithic technology at Tràng An.

A significant find of a shouldered axe was made by Dr Kahlert at Hang Bat Dua. Despite the absence of contextual information, I would place it to a later Neolithic period due to its technological characteristics and morphology. The similarity of the artifact to pieces found in other Southeast Asian contexts raises questions regarding population movements, cultural exchange, and technological diffusion over vast geographic areas.

6. Climate and dating – shell analysis

The chemical analysis of terrestrial and riverine molluscs forms the second of the two programmes of doctoral research being undertaken within the Project. This research has two principal objectives: Firstly, to produce a reliable calibration curve for radiocarbon dating terrestrial and freshwater molluscs from tropical settings. Such a system has already been established for Mediterranean latitudes by research completed recently at Queen's University Belfast (2015), and that work provides the methodological basis from which this part of the current study is being devised. Secondly, this work explores palaeoclimatic (monsoon precipitation) patterning, chiefly through chemical signals revealed within the shells themselves, as they were made. This objective builds on pioneering work carried out in Tràng An for another recent PhD (2013).

The aim of field collection during the March-April season in Tràng An was to begin establishing baselines in the molluscan data to see if long-term and/or geographic changes in shell composition are likely to affect the accuracy of radiocarbon dating tropical molluscs. In order to do this, shell samples were collected from a range of known stratigraphic contexts within Thung Binh 1 during the project's excavation of that site, together with off-site collection of modern specimens from different locations and altitudes within the northern and north western parts of the massif (principally around its perimeter). Off-site field collection was undertaken in association with the GPS work in order ensure the accurate locating of samples (see Table 2).

Discussion with local people reaffirmed that the best time of the year to see and collect cyclophorids is in May-June when they are plenty and can be found up on the limestone towers and around their base. Although, this was not the most ideal time of year, where-ever possible, live cyclophorids were collected, together with a sediment sample (1 small bag) or other material (e.g. limestone) from the immediate vicinity of the collection point. All data was recorded in an Excel spreadsheet in the field; all specimens were washed and dried prior to sampling for analysis or archiving at the Tràng An Management Board office.

Point_ID	Easting	Northing	Archaeological potential	Molluscan recovery	Alt (m)	Date
HANG TRAU BAI DINH	105.84903	20.30165	30cm+ of sediment, surface & buried historical, archaeological material.	Live specimens collected (taxa not recorded)	TBA	03/25/17
HANG MUOI	105.90853	20.27526	none, modified	Even though raining, no live snails were found; dead *Cyclophorus* sp. & bivalves found near rocks & around swamp.	TBA	03/25/17

Point_ID	Easting	Northing	Archaeological potential	Molluscan recovery	Alt (m)	Date
HANG BIN	105.89149	20.27514	Low potential. Possibly ex-water cave & modified for farm use	Snail shells of *Cyclophorus* sp. were found in between the limestone cracks and by entrance.	TBA	03/31/17
HANG DIA	105.90606	20.29015	None, temple Cave	Live *Cyclophorus* sp. found; very active even though some time since rain. Found all around the cliffs near temple, between rocks, dead leaves and branches. Sediment collected.	TBA	03/31/17
HANG BA CHUA	105.89344	20.28988	None, modified		TBA	04/02/17
THUNG BINH 0	105.86483	20.26204	Deposits present in some areas	Dead cyclophorids only collected at cave entrance + *Oxychilus* sp. Live juvenile Bradybaenidae found feeding on leaves.	TBA	03/24/17
HANG TRAU	105.87858	20.28361	Location verified	After rain. *Cyclophorus* sp. collected; appeared quite active on rocks	TBA	03/24/17
HANG ANG NOI	TBA	TBA	Excavated site (SUNDASIA + Institute of Archaeology)	No live cyclophorids found; modern specimens were collected from east of the cave in swamp.	TBA	04/01/17
HANG HANH	TBA	TBA	Excavated site (SUNDASIA)	Mixed + loose molluscs collected + modern *Cyclophorus* sp. shells.	TBA	04/01/17
HANG DOI	105.87305	20.24753	New site	Dead cyclophorid specimens collected.	46	03/30/17
HANG QUEN THUNG CHUA	105.87162	20.25036	New site	?	64.5	03/28/17
TRAN TEMPLE RESTHOUSE	N/A	N/A	N/A	*Cyclophorus* sp. shells, limestone & sediment collected. Shells were located under the rocks, within the soil; no live ones.	TBA	04/05/17

Table 2: List of sites (caves) where modern cyclophorid samples were collected (March/April 2017).

*(**Ioanna:** NB – highlighted coordinates don't match your Excel spreadsheet – poss. different format: please re-check all coordinates. There is also quite a lot of inconsistency between your notes and your Excel spreadsheet, and some between the sites names you use and those Thorsten used – please clarify. Please also add text on future recommendations for field collection, based on your experiences this season.)*

6.1 Recommendations