

Interdisciplinarity, participatory and preventive approaches in archaeology: Towards a new prehistoric and cultural heritage management model in Java, Indonesia

Interdisciplinarité, approches participatives et préventives en archéologie : vers un nouveau modèle de gestion du patrimoine préhistorique et culturel à Java, Indonésie

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Abstract: This paper aims to highlight the features of lay participation in research that can help to drastically improve the conservation of prehistoric heritage, and ultimately pave the way for a unique participatory and preventive archaeology model for Indonesia. The “Human Origins Heritage” Program is the result of the successful implementation of participatory archaeological excavations that began in the 1980s and were subsequently expanded in Sangiran, Java, Indonesia, an area known for its rich fossil deposits and significant *Homo erectus* discoveries. Launched in 2018, the program now includes participatory excavations with a field-based education module. The program includes training local community members and improving the quality of field data by conducting technical training in excavation and post-excavation work, participating in archaeological workshops, and addressing interdisciplinary scientific questions at the intersection of social and cultural heritage sciences. These efforts facilitate a deeper connection between researchers and local participants, making Sangiran a prototypical case study for the implementation of participatory approaches at Pleistocene sites in island Southeast Asia. The expansion of the program to Bumiayu is an opportunity to conduct a comparative analysis between an institutionalized site such as Sangiran and a community-driven site, highlighting the different dynamics of heritage management. The local communities at Sangiran and Bumiayu actively collaborate with museum staff and organize social events that combine heritage conservation with cultural practices. In addition, the Human Origins Heritage team is working with local museums to develop a preventive archaeology model tailored to the Indonesian context. The goal of this project is to anticipate potential archaeological risks through systematic surveys that integrate preventive measures with community engagement. This approach aims to lay the groundwork for a culturally sensitive and sustainable heritage management strategy.

Keywords: Sangiran, Bumiayu, participatory archaeology, collaborative archaeology, preventive archaeology, Prehistory, UNESCO.

Résumé : Cette étude vise à éclairer les différents aspects de la participation du grand public à la recherche qui peuvent permettre de construire un nouveau modèle d’archéologie préventive, où la participation des communautés tient une place importante. Le programme participatif « Human Origins Heritage » se déroule annuellement depuis 2018 sur le site UNESCO de Sangiran, Java (Indonésie), réputé pour sa richesse en faune éteinte et pour la concentration de restes d’*Homo erectus* la plus importante au monde. Il résulte d’une intégration progressive des populations locales de Sangiran aux activités archéologiques, débutée dans les années 1980. De 2017 à 2019, le programme s’adosse au chantier-école archéologique d’un site du Pléistocène inférieur et moyen, permettant de capter et

former des membres des communautés locales aux techniques de l'archéologie. Certains membres de ces communautés sont issus de familles liées à des découvertes majeures pour la documentation d'*Homo erectus* à Java. D'autres ont fondé des groupes communautaires de guides spécialisés dans la préhistoire, recrutant et organisant des activités locales qui animent l'intérêt pour le patrimoine au sein de leur société.

À partir de 2017, les orientations techniques et théoriques liées au projet « Human Origins Heritage » éclairent l'importance d'une implication communautaire pour la recherche archéologique et la sensibilisation au patrimoine. Cela permet non seulement d'envisager d'enrichir les connaissances issues des nombreuses découvertes fortuites — fréquentes en raison de l'érosion pluviale qui met régulièrement au jour des fossiles — mais aussi de renforcer le lien entre les communautés patrimoniales et les chercheurs.

La principale innovation d'Human Origins Heritage consiste en l'organisation annuelle, en plus des fouilles, d'un module pédagogique permettant à des étudiants provenant d'universités indonésiennes et européennes de travailler sur le terrain en collaboration avec les participants issus des communautés locales qui ont, pour la plupart, déjà participé au chantier-école. Les groupes ainsi formés effectuent des recherches interdisciplinaires et mettent également en avant des problématiques sociales spécifiques à Sangiran, créant ainsi un espace de dialogue entre le patrimoine et la vie locale. Des séminaires de restitution, au cours desquelles les participants de Sangiran présentent les résultats de leurs recherches à leur communauté et aux institutions locales, permettent d'observer, année après année, le développement des compétences et l'assurance des participants locaux.

Sangiran devient, avec le programme « Human Origins Heritage », un lieu d'expérimentation majeur des approches participatives sur des sites pléistocènes en Asie du Sud-Est insulaire. La participation des parties prenantes locales, notamment des musées, des autorités gouvernementales et des organismes culturels indonésiens, reflète un effort commun pour redéfinir le rôle du patrimoine dans la vie locale, avec pour objectif de renforcer la valorisation culturelle du site à travers la recherche, l'éducation et la participation communautaire.

Depuis 2023, le programme étend ses activités à la région de Bumiayu, dans l'ouest de la région de Java central. Celle-ci offre la possibilité de comparer un site institutionnalisé comme Sangiran et une région très rurale, où la préservation repose essentiellement sur des initiatives communautaires. Ainsi, par exemple, une communauté de la région porte un projet de musée qui combine la présentation de matériel archéologique, l'éducation des jeunes, l'implication des chercheurs et une intégration active dans le paysage culturel local. Sur la base de ces travaux et observations, l'équipe encadrante d'Human Origins Heritage et les musées de Sangiran s'attellent, en complément de l'intégration des communautés, au développement d'une archéologie préventive propre à l'Indonésie afin d'améliorer la possibilité de documenter le patrimoine archéologique, tout en s'appuyant sur les travaux d'aménagement en cours. Contrairement à l'archéologie de sauvetage, déjà pratiquée à une petite échelle dans le pays, qui intervient après la découverte de vestiges menacés, l'archéologie préventive anticipe les risques pour le patrimoine enfoui en menant des prospections systématiques. Sa mise en place peut se faire en vertu des lois déjà existantes en Indonésie, en particulier dans le cadre des études d'impact avant travaux. Elle nécessite toutefois un cadre institutionnel et des personnels formés.

Une archéologie préventive indonésienne, pour laquelle Sangiran et Bumiayu pourraient servir de projets pilotes, bénéficiera non seulement des pratiques documentées ailleurs, mais surtout de la participation active des communautés locales, habituées à une collecte de données scientifiques, dès sa conception. En devenant des acteurs de la conservation, les volontaires formés, comme ceux de Sangiran, contribueront de manière significative à la création d'un inventaire archéologique précis et cartographié hébergé par les institutions locales, prérequis essentiel à une protection efficace du patrimoine.

Mots-clés : Sangiran, Bumiayu, archéologie participative, archéologie collaborative, archéologie préventive, Préhistoire, UNESCO.

INTRODUCTION: SCIENTIFIC INTEREST OF INDONESIAN PREHISTORIC SITES AND THEIR RELEVANCE FOR INNOVATIVE APPROACHES IN ARCHAEOLOGY

The protection of archaeological heritage, especially of discrete prehistoric remains, requires coordinated action by legislators, institutions, researchers, and, ideally, local communities. Indonesia's *Homo erectus* sites on Java offer a unique opportunity to address these issues. Despite robust legislation and dedicated institutions, local communities are not always involved in heritage issues that directly affect them, leading to accidental damage, looting, and indifference. The “Human Origins Heritage” (HOH) Participatory Program (2018-2024) has demonstrated success in increasing public participation and fostering collaborative efforts between local

communities and institutions (Sukmi et al., 2021). When integrated with institutional frameworks, participatory approaches can improve field data collection, help protect sites from anthropogenic and natural threats, and pave the way for preventive archaeology.

Java has yielded nearly half of all known *Homo erectus* fossils, making it crucial to understanding the species (Indriati, 2004). *Homo erectus* inhabited the island from at least 1.5 Ma to possibly 0.11 Ma, making it an ideal location to study their adaptation to environmental change over more than a million years (Zaim et al., 2011; Rizal et al., 2019).

At the same time, community participation in Java has historical roots. During the colonial era, local contributions led to the first discoveries. In the late nineteenth century, the collaboration between E. Dubois, a Dutch scholar, and Javanese workers resulted in an extensive fossil collection, but colonial exploitation led to reports of misconduct, resulting in theft and destruction of fos-

sils (Albers and Vos, 2010). In the 1930s, the partnership between G. H. R. von Koenigswald, a German paleontologist, and Sangiran residents resulted in the first hominid fossil find in Sangiran (Tobias, 1976).

After Indonesian independence in 1945, local scientists T. Jacob, S. Sartono, R. P. Soejono, trained by G. H. R. von Koenigswald, advanced Quaternary paleontology with the help of local workers (Widianto, 2012; Iwan, 2018). In parallel, a second generation of locals continued this legacy in the 1970s, followed by younger residents in the 1980s and 1990s who were trained by the returning foreign teams, paving the way for collaborative approaches (Widianto, 2012; Iwan, 2018).

Since the late 1970s, prehistoric research has gradually become institutionalized. This was accelerated by the inscription of the Sangiran site on the UNESCO World Heritage List in 1996, and culminated in the construction of five large museums on the site.

The two lines of prehistoric research at Sangiran, one academic and the other community-based, are complementary but not very permeable due to a vertical, hierarchical relationship between researchers and workers. However, the local population has expressed a desire to participate in prehistoric research (F. Sémah et al.,

in press). Behind this desire are numerous local stories that connect individuals to their prehistoric heritage. In order to create a sustainable, open, and effective approach from a scientific perspective, it is crucial to understand the complex factors that contribute to participation and to help them organize.

1. PARTICIPATORY ARCHAEOLOGY AND ITS EARLY DEVELOPMENTS IN SANGIRAN, JAVA

1.1. Special features of participatory archaeology at the UNESCO World Heritage Sangiran Site, Java, Indonesia

The 5,000 km long archipelago of Southeast Asia provides a unique setting for the study of past evolutionary processes. It is the result of the convergence of the Australian and Pacific plates, resulting in intense seismic and volcanic activity (Saint-Marc et al., 1977). It spans two continental shelves, Sunda and Sahul, separated by Wallacea, a deep-sea region (fig. 1). Pleisto-



Fig. 1 – The Southeast Asian archipelago within its current, interglacial, configuration (green); The Southeast Asian archipelago configuration during glacial periods, at about -120 m under the current sea level (beige; CAD C. Biets, after Voris, 2000).

Fig. 1 – L'archipel sud-est asiatique dans la configuration interglaciaire actuelle (en vert) ; l'archipel sud-est asiatique dans sa configuration glaciaire, environ 120 m en dessous du niveau actuel des océans (en beige ; DAO C. Biets, d'après Voris, 2000).

cene eustatism alternated between insularity and continentalization, making the archipelago critical for studies of climate and biogeography (Vos et al., 2007; Roberts and Amano, 2019). Java, at the tip of Sunda, extends 1,000 km and hosts important Pleistocene sites, notably Sangiran and Bumiayu, where Early and Middle Pleistocene hominid-bearing strata are exposed by erosion (Bemmelen, 1949; F. Sémah, 1986; Aswan et al., 2018, here: fig. 2).

Sangiran's Pleistocene deposits formed a dome that was eroded by the Cemoro River, creating a concentric exposure with the oldest levels in the center (Bemmelen, 1949; here: fig. 3). This 59.21 km² site reveals over a million years of environmental and faunal change. There, the legend of *Balung Buto* ("bones of giants") reflects a long-standing cultural connection between local communities and prehistoric heritage (Handini, 2015; here: fig. 4).

This relationship changed with the arrival of early researchers, who prioritized fossil collection over stratigraphic context. This culminated in the 1960s-70s when Krikilan's village chief, Totomarsono –who had worked with G. H. R. von Koenigswald– centralized local finds,



Fig. 2 – Location of the Sangiran and Bumiayu regions on the Java island (CAD C. Biets, after T. Ingicco, unpublished).

Fig. 2 – Localisation des régions de Bumiayu et de Sangiran sur l'île de Java (DAO C. Biets, d'après T. Ingicco, inédit).

founding Sangiran's first museum (Suratmo, 2013; Iwan, 2018). To this day, private collections of artifacts and fossils remain common, awaiting scientific documentation.

In this context, and despite regulatory measures, the illicit fossil trade remains a threat (Unesco, 2013 and 2017). Fossils can be highly profitable in a region where

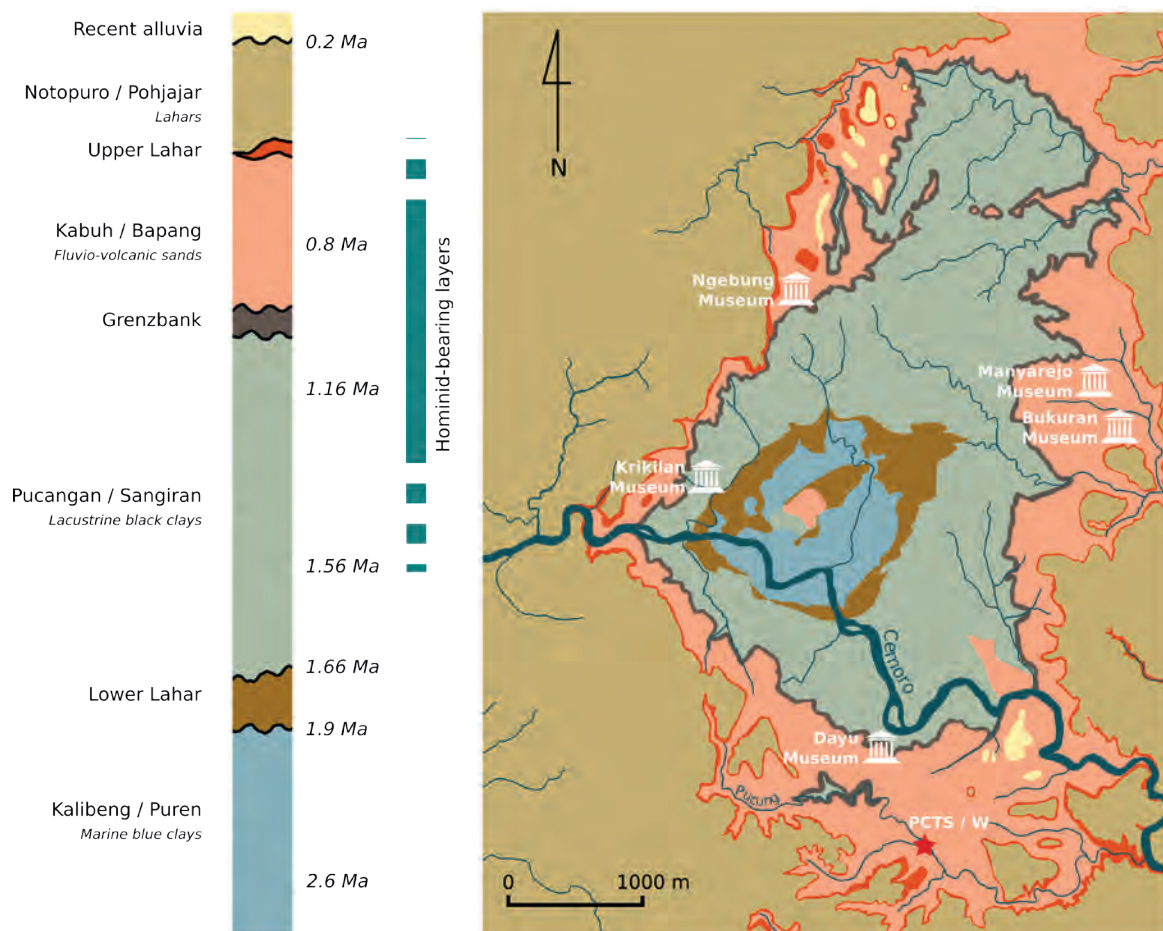


Fig. 3 – Stratigraphic sequence of the Sangiran site showing, in plan and cross-section, the distribution of the various major geological formations in the region (CAD C. Biets, after Brasseur et al., 2015).

Fig. 3 – Séquence lithostratigraphique du site de Sangiran montrant, en plan et en coupe, la distribution des formations les plus importantes de la région (DAO C. Biets, d'après Brasseur et al., 2015).



Fig. 4 – This illustration (detail, acrylic on vellum, circa 2010, Klaster Manyarejo) depicts the legendary *Balung Buto*. The prince Raden Bandung Bandawasa is represented on the upper portion of the illustration as *Homo erectus*, confronting the king of the giants, Tegopati, on the central portion of the illustration (credits HOH).

Fig. 4 – Cette illustration (détail, acrylique sur vélin, années 2010, Klaster Manyarejo) illustre la légende du *Balung Buto*. Le prince légendaire Raden Bandung Bandawasa est représenté en haut, sous les traits de *Homo erectus*, dans sa confrontation avec Tegopati, le roi des géants, figuré au centre (crédits HOH).

agriculture and informal work keep many incomes below the minimum wage (BPSKS, 2024; Medina, 2024). This trade is one of several obstacles affecting the scientific reliability of fortuitous discoveries at Sangiran. To address these scientific and social challenges, two main directions have been explored: community participation, based on experimentation, and prevention, leading to a prospective discussion with the cultural authorities of Sangiran.

1.2. Archaeological digs: a link between researchers and local people, and a training ground for participants

The Pucung Tanah Subur (PCTS) field school was established following the discovery of several sites by local residents in southeastern Sangiran (Purnomo, 2013; Ansyori, 2018). This annual month-long excavation focuses on the artifacts and environment of *Homo erectus*. From 2009 to 2019, PCTS served as a case study for participatory archaeology (Ferdianto et al., 2018; Biets, 2021; F. Sémah, 2021), involving ten community members and, since 2017, heritage guides from the local Pokdarwis WS community (Biets, 2021). Over two years, a dozen guides were trained in excavation, recording, geomorphology, drawing, and sieving.

Each campaign ended with presentations by students and local participants to encourage feedback and monitor

interest. The success of the program was based on a scientific management approach that integrated local research, awareness, and recruitment.

Building on this experience, the research team collaborated with Universitas Kristen Satya Wacana (UKSW), the university of Salatiga, to develop a broader participatory program that increases participant autonomy, collectively defines research priorities, and integrates local input into the scientific process (Ansyori et al., 2016; F. Sémah, 2021). The PCTS excavation represents the first step in implementing broader participatory and community-based approaches to archaeology in Sangiran.

2. A PARTICIPATORY PROGRAM TO TEST NEW AVENUES OF HERITAGE SCIENCE: “HUMAN ORIGINS HERITAGE”

2.1. Main aspects of the “Human Origins Heritage” Program

The HOH Program builds on previous initiatives by our team between the 1980s and 2010s (F. Sémah and Setiagama, 2007; Ansyori et al., 2016) and is aligned with UNESCO’s “Human Evolution: Adaptations, Dispersals, and Social developments” (HEADS) Program¹, while building on the experience of the French participatory network “Science ensemble”². Since 2018, it has integrated community engagement into heritage studies in Sangiran (Rupidara, 2021).

HOH promotes the participation of local volunteers in heritage management, ensuring that their insights inform conservation efforts. By integrating research questions from local society, the program aims to make heritage research more responsive to community needs. Effective collaboration between local residents, government agencies, and interdisciplinary teams is facilitated by organizing informal meetings and interactions. This collaborative approach enhances the transfer of heritage knowledge by combining local expertise with international perspectives.

To this end, the program is organizing an international participatory course on prehistory and heritage in Java (F. Sémah, 2021). It is open to students from UKSW, the European International Master in Quaternary Prehistory (IMQP)³, and other Southeast Asian universities with backgrounds in prehistory, archaeology, tourism, communication, and development studies (Ingicco et al., 2021). The course promotes practical experience, interdisciplinary training, and strengthens Indonesian-European academic networks (Prabawa et al., 2021; F. Sémah, 2021). Since 2024, students have also been connected to local communities through the “World Heritage Volunteers” Program.

From 2018 to 2024, HOH engaged participants from 25 countries, primarily Indonesia and France (Sukmi, 2024). Its interdisciplinary framework encourages diverse methodologies, adaptability, and active community engagement. Local groups are integrated into field-

work, allowing participants to address both the natural and social dimensions of prehistoric research and conservation while building a laboratory for inclusive and innovative methodologies.

2.2. Challenges

2.2.1. From the student's perspective

Ensuring that data collection aligns with community needs while maintaining scientific rigor and engaging with local communities in multidisciplinary, multicultural contexts is a major challenge for students, who are often unaccustomed to participatory approaches (Ingicco et al., 2021; A.-M. Sémah et al., 2021). On the one hand, the implementation of participatory methods challenges them to reflect on the epistemological aspects of their disciplines. On the other hand, although Javanese students understand local norms, their urban-educated or Western counterparts struggle to connect with rural communities.

Diverse cultural and academic backgrounds enrich discussions, but also create challenges for collaboration. European students often lack contextual knowledge, while non-prehistorians need to acquire basic skills. These “real life” experiences reflect future professional challenges and prepare students for interdisciplinary and cross-cultural research.

2.2.2. From the local participants' perspective

By prioritizing the contributions of local participants, the HOH Program seeks to recognize local perspectives for their scientific and cultural significance. As key intermediaries between students and the community, local participants are expected to advance the educational and research outcomes of the program (F. Sémah, 2021; Sukmi, 2024). This means that the locals must move from a role of logistical support, such as organizing meetings with village chiefs or former fossil hunters, to a more active role in research and dissemination, relying on their often lacking confidence and skills.

In addition, local participants must position themselves as mediators between scientists and local society, combining traditional knowledge with scientific understanding (while overcoming the language barrier). This bridging role is critical in fieldwork, especially when dealing with local myths and cultural narratives, where their insights are essential (Saputra et al., 2021; Sukmi, 2024).

2.3. Solutions

Collaborative project design helps mitigate power imbalances by valuing local knowledge, while interdisciplinary groups enhance scientific discussions (Ingicco et al., 2021; A.-M. Sémah et al., 2021). The presence of students, as opposed to senior researchers, also promotes local freedom of expression.

HOH research topics help balance practical concerns with conceptual explorations, grouped into three categories:

museum-heritage-society relations, prehistory, and participatory science (Sukmi et al., 2021). Heritage-focused studies analyze museum-community dynamics through interviews and observation, while interdisciplinary approaches assess the societal impact of museums. These themes make it possible to place the local voice at the center of research, allowing locals to experience the value of their knowledge.

Prehistory topics explore scientific techniques structured around lithic studies, paleontology, geology, and experimental archaeology, helping participants to recognize skills acquired during excavations, for example (Gutiérrez et al., 2021; Irfan et al., 2021). In 2018, a HOH group adapted a participatory protocol for archaeological investigations for 10-year-old pupils, demonstrating that science can be easily adapted to a very young audience (Anggraeni et al., 2021). This initiative broadened access to archaeological recording and integrated fossil collecting into education.

Some members initially joined for financial reasons, but developed a scientific interest through the workshops and thus gained the confidence to share their knowledge publicly (Gutiérrez et al., 2021; Irfan et al., 2021; Manik et al., 2021). Training in scientific methods and archaeology undoubtedly improved employability and heritage tourism skills (Sukmi, 2024), fostered deeper environmental engagement, and increased self-confidence among participants. This type of awareness has historically been key to identifying new archaeological sites, such as PCTS, and thus fulfilling one of the primary goals of heritage conservation efforts: site location.

3. THE “HUMAN ORIGINS HERITAGE” PROGRAM PERSPECTIVES AND DEVELOPMENT

3.1. The Bumiayu area

The interdisciplinary strategies at Sangiran promote community involvement in archaeological research (table 1). Extending this approach to other key sites, such as Bumiayu, opens up new frontiers for community-driven conservation efforts.

Like Sangiran, Bumiayu offers insights into early human migrations. Its stratigraphy, where marine and continental layers meet earlier than at Sangiran, is exposed in river-cut sections (Sumarso & Suparyono, 1974). Faunal deposits at sites such as Kali Glagah, Kali Biuk, and Ci Saat (1.8-1.9 Ma) have yielded rich assemblages (Vos et al., 1982; Zaim et al., 2011; Aswan et al., 2018), but the lack of systematic excavation limits their archaeological significance.

The hamlet of Dukuh Tengah, within Bumiayu, has become a local hub for fossil preservation. Seven residents, known as Pelestari (“heritage caretakers”), work with the community-run Buton Museum (“Bumiayu-Tonjong Museum”), a structure that preserves the region’s prehistoric heritage. Fossils, mainly collected from river-

Challenges	Solutions
Diversity among students (education, culture, languages)	- Indonesian students act as intermediaries
Power relationship between locals and researchers (professionals, academics, students)	- Participants co-construct their research topics - Local participants supervise and guide the work - Participants have time to present work to members of their communities
Knowledge transfer to local communities	- Popularization of science, workshops and emphasis on field data acquisition techniques - Encourage local curiosity about archaeological work
Multi- and interdisciplinary research topics	- Allow research topics to be nourished by social considerations and the material reality of communities with regard to heritage conservation issues

Table 1 – This table presents the challenges and solutions to the primary issues encountered by the HOH program while on-site.

Tabl. 1 – Ce tableau présente les difficultés et les solutions aux principaux problèmes rencontrés durant la phase de terrain du programme HOH.

beds, range from fragmented remains to significant finds such as proboscidean tusks. The Pelestari are currently working with Sangiran researchers to catalog their collections, which are stored in their homes (fig. 5).

They also want to build their own community museum, a *rumah fosil* (“fossil house”), to centralize these collections. This museum would be located next to the village *pendopo* (“community house”). It would combine local architecture with educational efforts, even including a botanical garden for children.

Despite financial constraints and ownership disputes, the Buton Museum and partnerships between local people and researchers offer a promising conservation model. Like Sangiran, Bumiayu has the potential to demonstrate the role of community-driven heritage conservation. This potential can be supported by participatory approaches in the same way as in Sangiran.

Integrating the HOH Program in Bumiayu allows for a comparative analysis of development, tourism, and institutional dynamics, while amplifying local voices in



Fig. 5 – A representative of the Dukuh Tengah Pelestari organization engages in discourse with researchers from the HOH team to ascertain the potential of his personal fossil collection for exhibition and conservation purposes (credits HOH).

Fig. 5 – Un membre des Pelestari de Dukuh Tengah discute avec des chercheurs du programme HOH afin de déterminer le potentiel patrimonial de sa collection de fossiles personnelle afin qu'elle soit exposée et conservée dans de bonnes conditions (crédits HOH).

heritage management. It will also pave the way for the development of innovative, community-driven heritage conservation, prior to and complementary to the establishment of a comprehensive institutional framework.

3.2. The *kampung*, *kampus*, *musium* approach: A community-based model for participation

The *kampung*, *kampus*, *musium* framework represents a bottom-up collaborative model for integrating local heritage, education and community development. It emerged in 2022 from the collaboration of people from the village of Manyarejo, Sangiran, and Wahyu Widiarta, director of the Ngebung Museum in Sangiran, who is a strong supporter of the community. This approach seeks to harmonize the strengths of a traditional *kampung* (“urban or rural settlement”), the educational potential of a *kampus* (“campus”), and the exhibition and collaborative aspects of a *musium* (“museum”). The goal is to empower local initiatives in Manyarejo while fostering collaboration between the community, local institutions, and researchers. This model is designed to facilitate sustainable heritage management, cultural preservation, and educational growth, while promoting knowledge exchange, tourism, and community-led conservation.

Kampung refers to an informal settlement built according to community-specific rules (Geertz, 1965; Rahmi et al., 2001). Manyarejo’s community organizes local cultural activities and seeks community-run tourism through dialogue with researchers and the Indonesian Heritage Agency (IHA). In fact, their village has the capacity for both economic development and science education for younger generations. Manyarejo has produced numerous fossils from the Kabuh Formation, about 0.78 Ma (F. Sémah, 1986; Saleki, 1997; F. Sémah et al., 2001), mainly through the work of five elders, former fossil hunters. Their connections with leading Indonesian researchers such as T. Simanjuntak and H. Widiarto deepened local interest, culminating in the construction of the Manyarejo Museum, which bridges prehistoric research and community engagement. In Manyarejo, the concept of *kampung* embodies self-managed heritage, empowering residents as custodians of their cultural landscape. Through education and self-regulation, they balance conservation with sustainable tourism, ensuring that development is consistent with community values.

Kampus emphasizes the connection between academics and the Manyarejo community, and aims to improve local accommodations with standardized criteria to attract research and education-oriented visitors. Located off the main tourist routes, Manyarejo currently sees little tourism. The project, which is still in its early stages, addresses social, architectural, environmental and sanitary aspects. For example, the preservation of traditional wooden houses is in line with Gotong Royong, the communal labor system (Rahmi et al., 2001; Slikkerveer, 2019). Traditionally, residents built wooden houses collectively, whereas concrete or brick houses require hired labor, increasing costs and undermining communal

practices. Restoring traditional houses could help maintain local traditions and social structures, attract foreign researchers, and allow for the redistribution of tourism benefits within the community. Residents want to use the presence of researchers for education while maintaining traditions. Improving accommodation is key to this vision, as it encourages long-term academic stays. This *kampus* initiative lays the groundwork for Manyarejo’s transformation into a “small popular university,” in the words of Wahyu Widiarta.

Musium highlights the collaboration between local heritage stakeholders, particularly museums, as exemplified by the 2023 National Heritage Day Manyarejo Festival. This event mobilized local museum staff, academics, and residents of Manyarejo. The festival combines education, economy, culture, and social engagement. Community members collectively organize it through Gotong Royong, volunteering their time without direct payment. To fund the festival, some have partnered with a local landowner to invest in a herd of goats, sharing profits based on contributions (fig. 6). In addition to artistic performances, the festival highlights fossils excavated from the cliff above the site. Institutional archaeologists had surveyed and partially excavated the area, revealing visible, in situ mammal fossils (BPSMPS, 2022a and 2022b; here: fig. 7). One organizer sees these fossils as an opportunity to shift the focus from the specimens to the archaeological site itself, transcending the *musium* concept: unlike museums with impressive fossil displays, the site’s context offers the potential for interpretive explanation, a challenge with high, horizontal educational potential.

The emergence of such community-based initiatives, in parallel with the HOH Program, shows that there is a desire to further protect the heritage while keeping it accessible to all. In Sangiran, this is the role of local and national institutions. Any further institutionalization could create a sense of dispossession among the commu-



Fig. 6 – The Brayat Krajan Sangiran is partially funded by the profits from this shared herd. Investors receive equal shares of the profits (crédits HOH).

Fig. 6 – Le Brayat Krajan Sangiran est en partie financé par les revenus générés par un troupeau collectif de chèvres. Les investisseurs reçoivent une part égale de ces profits (crédits HOH).



Fig. 7 – a) One or more levels show a concentration of fossils on a relatively horizontal plane. The presence of these levels could indicate the proximity of a significant archaeological site; b) The festival organizers aimed to present these fossils in their original context so that the public could appreciate the importance of the site, beyond just the fossils themselves (credits HOH).

Fig. 7 – a) *Un ou plusieurs niveaux présentent une concentration de fossiles dans une position relativement plane. La présence de ces niveaux pourrait indiquer la proximité d'un site archéologique important ; b) Les organisateurs du festival souhaitent présenter les fossiles dans leur contexte original afin que le public puisse être témoin de l'importance du site, au-delà des seuls fossiles (crédits HOH).*

nities. This is a unique opportunity to develop a new form of archaeological heritage management and protection, partially community-led, that can benefit both research and the local population.

4. TOWARDS A MODEL FOR PREVENTIVE ARCHAEOLOGY AT INDONESIAN HERITAGE SITES

4.1. Transitioning from participatory archaeology to preventive archaeology, what is at stake?

The HOH Program highlights significant progress in engaging communities in heritage conservation. Moreover, by participating in excavations and research, members of the local communities have transformed their roles from supporters to active contributors.

In order to develop an effective (and inclusive) heritage management and protection policy for regions such as Sangiran and Bumiayu, and possibly beyond, it is essential to assess Indonesia's strengths and areas for improvement in this area. Archaeological heritage conservation faces significant challenges from human and natural threats, and effective protection is only possible for sites that have been properly identified, inventoried, and mapped.

In this regard, Indonesian rescue archaeology typically follows unintentional discoveries, but may not be sufficient for large development projects (Fauzi et al., 2023). Nevertheless, with its rich heritage, Indonesia has a critical opportunity to improve conservation through legislative adjustments and strategic planning that balances conservation and development.

The distinction between reactive rescue archaeology and proactive preventive archaeology is critical: preventive archaeology integrates heritage management

into land development, allows for collaboration between developers and archaeologists, and shifts the focus from isolated artifacts to comprehensive site analysis (Demoule, 2007). Strengthening preventive archaeology in Indonesia could focus on three areas: adapting building permit processes to trigger investigations, engaging communities in scientific programs to uncover hidden sites, and improving quality control of archaeological reports for national heritage mapping. In addition, prioritizing the publication of results could raise the profile of heritage management in Indonesia.

4.2. From rescue to preventive, participatory archaeology at Sangiran and Bumiayu

4.2.1. Shifting from rescue to preventive archaeology

Archaeological heritage is a non-renewable resource, and its destruction, whether by human activity or natural causes, has an irreversible impact on our understanding of history. Strengthening preventive archaeology is essential to meet this challenge, as it allows for a systematic assessment of an area's archaeological potential and supports targeted protection strategies⁴. Unlike rescue archaeology, which responds to accidental discoveries, preventive archaeology proactively identifies sensitive sites, optimizes resource allocation, and minimizes unnecessary excavation.

The protection of archaeological heritage relies on legal frameworks that define the heritage, regulate excavation conditions, and establish institutional oversight. In Indonesia, Law No. 11 of 2010 provides the legal basis for rescue archaeology by defining cultural heritage (*cagar budaya*) and setting guidelines for excavation permits. Ownership of archaeological remains is vested in

the state, ensuring heritage management even on private land.

Despite this legal structure, rescue archaeology remains underdeveloped, especially in the context of large-scale projects such as the relocation of the capital (Fauzi et al., 2023). A major challenge is the lack of a dedicated funding model. In other countries, the “polluter pays” principle finances archaeological work (Novaković et al., 2016), but its implementation requires strict oversight to prevent conflicts of interest.

Mining and development projects are already subject to preliminary impact assessments in Indonesia (Hadi et al., 2023; Suprpto, 2023). A viable solution would be to integrate archaeology into the existing environmental impact assessment framework. Expanding these regulations to include archaeological assessments would facilitate early site identification and heritage conservation without placing additional burdens on public budgets.

4.2.2. Building on participatory approaches

A participatory approach can significantly increase the archaeological knowledge of a given area, especially in regions with a rich heritage, by improving the quality and quantity of field data. Through their networks, local

communities can gain access to private lands and monitor threats in real time, such as erosion or construction activities (fig. 8). In addition, maintaining a high level of community involvement through participatory approaches helps to prevent the development of mistrust or disinterest. It also allows archaeology to be used as a tool for scientific and research education.

One of the main advantages of the situation at the Sangiran site is that the implementation of participatory approaches has demonstrated the potential for expanding community participation by employing local participants as technicians during archaeological surveys and excavations. Organizing activities into workshops allowed participants to develop their interests, skills, and autonomy, and to contribute to the scientific outcomes of the excavation (Biets, 2021; Sukmi, 2024). Feedback sessions after fieldwork helped to monitor participants’ improvements while providing a platform for them to present their findings, potentially leading to the recruitment of more participants. Training people through participatory methods allows for the creation of a potential source of income based on specialized excavation skills that could benefit local communities, thus replacing the current monetary compensation system supported by public institutions.



Fig. 8 – The discovery of large mammal fossils following a 2023 landslide in Bukuran, Sangiran, prompted a cascade of inquiries from local communities, requesting that HOH students collect and document the findings (credits HOH).

Fig. 8 – La découverte des fossiles d'un grand mammifère à la suite d'un glissement de terrain en 2023, à Bukuran Sangiran, a mobilisé différents acteurs des communautés locales, qui ont demandé aux étudiants d'HOH qu'ils prélèvent et documentent les découvertes (crédits HOH).

4.3. Indonesia's future preventive archaeology: anticipating problems to address

The protection of underground heritage depends on the notification of construction projects to the cultural authorities. In Sangiran, construction permits are required for excavations deeper than 50 cm⁵. However, excessive paperwork currently leads to unreported or abandoned projects, jeopardizing heritage conservation. To assist in the application of such regulations, administrative staff could help communities navigate the bureaucracy, building trust and directly benefiting local people.

In terms of implementation, Indonesia's cultural institutions can oversee preventive archaeology on several levels. This process begins with continuous mapping of sensitive sites, which can include a participatory scientific protocol. Such data can be integrated into a national heritage database, similar to the French Patriarche, to facilitate long-term site protection (Chaillou and Thomas, 2007; Lasfargues, 2009).

Based on these archaeological maps, government agencies can mandate preliminary diagnostic studies prior to construction, conducted by public sector archaeologists who assess archaeological risk in rapidly published reports (Demoule, 2007). Fieldwork continues with the excavation of test trenches that cover 8-13% of the site, depending on local practices and sedimentary contexts (Legendre, 2019). If necessary, full-scale excavations follow, and operational reports containing all data, inventories, and preliminary results are submitted to the cultural authorities for conservation and research.

A sustainable financial model is crucial for the transition from rescue to preventive archaeology. Many countries apply the "polluter pays" principle, making developers financially responsible (Novaković et al., 2016). However, this model carries the risk of developers influencing decisions, which could compromise scientific quality (Depaepe, 2016). Striking a balance requires strong administrative oversight while avoiding excessive and often slow bureaucracy.

Improving Indonesia's approach will require skilled, specialized teams to ensure data accuracy. Trained technicians from programs such as PCTS excavations contribute to both research quality and local employment. In addition, all reports, including raw data, should be peer-reviewed by a scientific committee to prevent data loss and potential misconduct. Providing Indonesian teams with resources and time to publish will increase the visibility and credibility of their model of preventive archaeology nationally and internationally.

CONCLUSION

The participatory and interdisciplinary approaches in Sangiran and Bumiayu illustrate the integration of local communities in heritage management, ena-

bling knowledge transfer and sustainable conservation (Prabawa et al., 2021; F. Sémah, 2021). In Sangiran, community-led initiatives such as *kampung*, *kampus*, *musium* in Manyarejo link heritage, education and community engagement to balance conservation with economic opportunities. The proactive role of local stakeholders, from fossil caretakers in Bumiayu to institutionally managed museums in Sangiran, highlights a shift toward decentralized conservation models that empower local agency while holding potential for mitigating risks such as unregulated development and fossil trade.

Building on this situation, a structured framework for preventive archaeology in Indonesia could be integrated into existing environmental impact assessment regulations, aligning heritage protection with national development policies (Hadi et al., 2023; Suprpto, 2023). Beyond regulatory measures, Indonesia has the opportunity to pioneer a model of preventive archaeology rooted in the Global South, where collaboration with local communities fosters decentralized heritage management. Although organizational and financial challenges remain, this approach could drive innovative conservation strategies while ensuring long-term, sustainable sites protection.

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NOTES

1. whc.unesco.org/en/heads/
2. www.science-ensemble.org
3. www.quaternaryprehistory.eu
4. <https://www.coe.int/fr/web/conventions/full-list?module=treaty-detail&treatynum=143>
5. Testimonies were gathered from Wulandari (IHA), and A. S. Sajekti (Sragen district government).

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