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The Great East Japan Earthquake and cultural heritage: towards an archaeology of disaster

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Introduction

The earthquake that struck Japan on 11 March 2011, named the Great East Japan Earthquake by the Japanese government, was one of the largest seismic events the world has seen for generations. Akira Matsui reported his experience of visiting the areas devastated by the earthquake and tsunami soon afterwards, outlining the initial assessment of damage caused to museums and cultural heritage assets, and the plans for their rescue (Kaner *et al.* 2011; Matsui 2011a). The present contribution reports how far the implementation of these plans has been successful, the prospects for the future, and situates all of this in a broader context of archaeological response to earthquakes.

This is not the first time that Japan has been obliged to address these matters. Within recent memory, the Great Hanshin Awaji Earthquake, which struck the city of Kobe and the surrounding region in 1995, resulted in the loss of more than 5000 lives and caused immense damage to cultural heritage. A systematic rescue of cultural heritage assets, including archaeological sites, was then organised. The fact that Japan has experienced two major earthquakes within just 16 years compels us to start thinking seriously as to what we as archaeologists can do to prepare for future disasters of equal magnitude. In this globalised world, we also feel strongly that our experience, and what we have learnt, should be shared with colleagues the world over.

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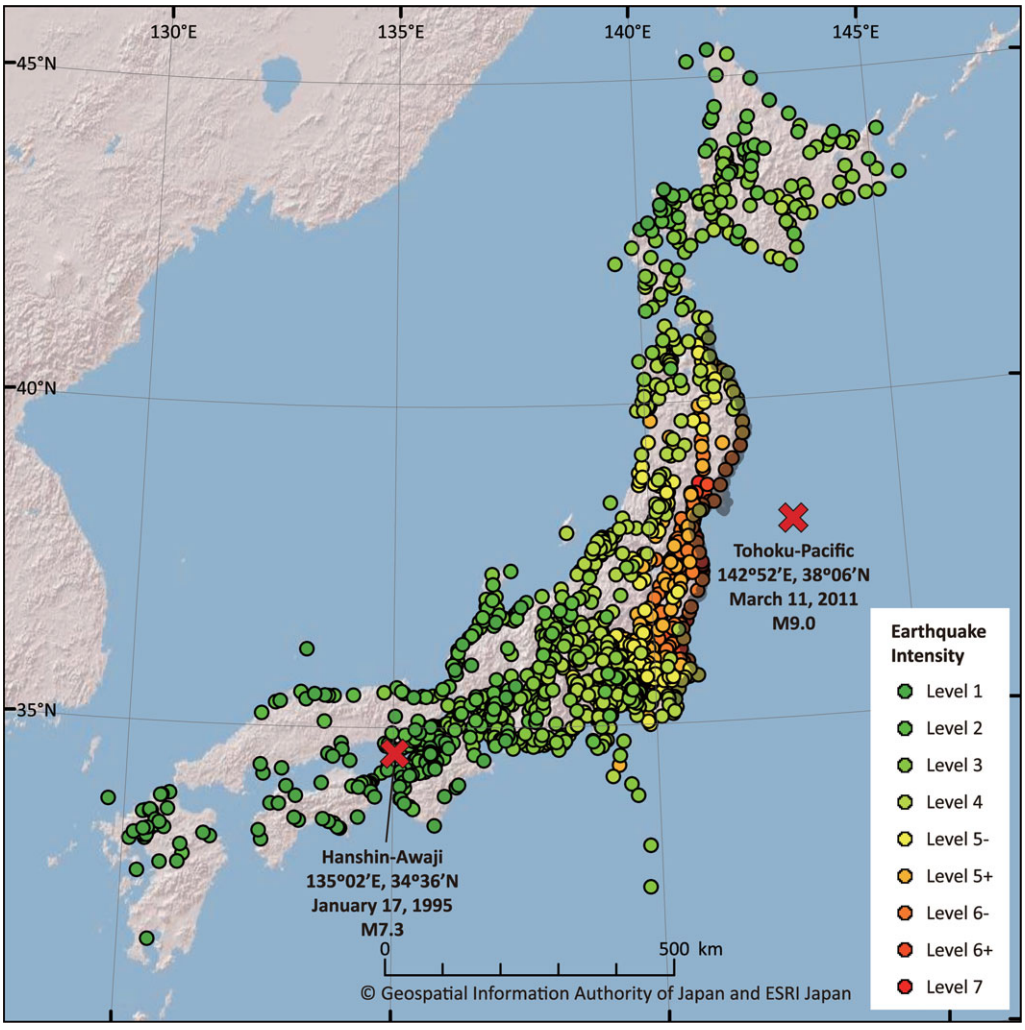

Figure 1. Map showing the epicentres of the Great Hanshin Awaji and Great East Japan earthquakes, earthquake intensity distributions, and the extent of the tsunami damage caused by the latter (indicated by the dark grey strip along the north-eastern coastline of Honshu island). The extent of the tsunami's reach is mapped by the Geospatial Information Authority of Japan; mapping of earthquake intensity distributions was conducted by the EMT (Emergency Mapping Team). The base map is offered by the ESRI Japan, Co. Ltd.

The event (Okamura)

The Great East Japan Earthquake affected a vast area, covering parts of the Tohoku and Kanto regions, and stretching for more than 500km from north to south (Figure 1). In Miyagi, Iwate and Fukushima prefectures there was particularly severe damage. The consequent tsunami tidal wave reached more than 30m in height in some areas, inundated areas up to several kilometres inland, and destroyed virtually everybody and everything in its path. To make matters worse, the Fukushima No. 1 nuclear power station of the Tokyo Electric Power Company was catastrophically damaged and has since been causing serious radiation

contamination. This has resulted in the evacuation of residents within a 20km radius of the plant. The serious radioactive contamination of the evacuation zone might make any excavation or other archaeological investigation, let alone re-habitation, impossible for many years to come.

The damage caused to cultural heritage was very serious and wide-ranging. Speaking only of designated national cultural properties, more than 700 are confirmed to have been damaged, including five national treasures (i.e. recognised as monuments of the highest importance for the nation), 160 important cultural properties, 90 historic sites and buildings, as well as hundreds of paintings, carvings, crafts, ancient documents, ethnological and archaeological artefacts (Agency for Cultural Affairs 2012). Museums and archives located near the coast were damaged by the tsunami, and those located inland by the strong tremor. The local administrative officers who are normally in charge of matters concerning cultural property protection and management naturally concentrated their work on the reconstruction of people's everyday lives. In many cases they themselves, and their families, were victims of the devastation.

Assessing the damage (Fujisawa)

Accurate estimation of the nature and scale of the destruction to cultural heritage remains impossible in many areas of the devastated zone, although assessment of the damage caused to important cultural properties has made some progress. Access to privately-owned cultural properties is particularly difficult, and it will be a long time before a complete and detailed picture of the devastation becomes available.

More cultural properties were damaged by the earthquake than the tsunami. The stone walls of many castles and fortresses were shaken, and numerous *tohroh* stone lanterns and monuments in temples and shrines collapsed. On the other hand, the total loss or damage to architectural heritage was more severe in areas devastated by the tsunami. The number of tangible cultural properties washed away, including works of art, is still unknown. Many of those that escaped being washed away were temporarily submerged and severely damaged. The earthquake devastated many properties located in coastal and inland areas, resulting in a vast number of historical documents needing urgent conservation.

Many cultural storage facilities were buried not only by sandy and muddy sediments but also by other debris; only a small number situated on higher ground escaped damage from the tsunami (Figure 2). The artefacts stored in the damaged facilities had to be retrieved quite literally by excavation. In the Yamada township of Iwate prefecture, the storage facility and everything it housed were almost wholly washed away; only very little survived. Most of the remaining properties were completely covered by mud and debris. At the storage facility of the Ishinomaki Municipal Museum, close to a damaged paper-making factory, the sediment which buried it was mixed with a large amount of congealed paper. The museum of the Onagawa township is located adjacent to a port, and the artefacts here had to be rescued by shifting sediments, including consolidated heavy crude oil and rotten fish. The cleaning of such rescued items will take a long time. It also remains uncertain when, or if at all, the rescue of cultural properties left behind in the area contaminated by radioactive substances that have leaked from the Fukushima No. 1 nuclear power plant will be able to begin.

Figure 2. Nobiru storage facility, Higashimatsushima municipality. The state of devastation on 31 May 2011, two months after the tsunami (photograph: Atsushi Fujisawa).

Because of the severity and enormity of the damage caused by the tsunami, national and regional governments have proposed relocating and reconstructing the devastated settlements on higher grounds, free of the fear of future tsunami damage. Concern for avoiding any repetition of the tragedy and associated damage makes this a likely move. However, the higher ground designated for such relocation in many cases coincides with areas of densely-distributed archaeological sites and, if the plan goes ahead, a large number of archaeological sites will have to be rescue excavated (see below).

Earthquakes and the archaeological record (Fujisawa)

Earthquakes of the magnitude experienced in March 2011 are estimated by seismologists to have happened in the affected area about once every 1000 years. The last earthquake on this scale occurred in AD 869, during the Jogan era of the Heian period. Because of the rarity of seismic events of this scale, most of the public today had no idea that a tsunami tidal wave could reach as far inland as was inundated in 2011. In fact, however, the record of the Jogan earthquake and the tsunami it caused is well known to scholars specialising in the history of the Tohoku region. Excavations conducted around the ancient administrative centre of the region, Taga-jo, yielded clear evidence of the Jogan tsunami. The excavation

of the Kutsukata site, for example, which dates from the Middle Yayoi period, revealed a layer of tsunami deposits covering paddy fields in use around 2000 years ago.

It seems that it was only archaeologists who could have made it known to the general public that tsunamis of the scale of the 2011 disaster have inundated the Sendai plain in the past. Regretfully, however, despite the efforts by those who conducted the excavations, and a limited number of concerned scholars, there was no sense of urgency in making the information yielded by these excavations more widely known. It is increasingly accepted that interdisciplinary collaboration, both in the excavation and examination of the results, enables the accurate recognition of traces of past earthquakes and tsunamis. This information should be utilised for devising public disaster prevention measures and informing the planning for any future such eventualities.

The tremendous damage caused by the earthquake and tsunami has clearly shown the importance of the contribution that archaeologists can make to the protection of people's lives. If this lesson is to lead to some constructive initiatives, perhaps the lives of the 20 000 people lost on this occasion will not be in vain.

The response in 1995 (Okamura)

The Great Hanshin Awaji Earthquake of 1995 struck a large, densely-populated urban area. Remarkably, due to the existing urban planning policy, the Hyogo Prefectural Board of Education managed to grasp the extent and character of the damage caused to archaeological sites in the ten cities and ten towns and villages affected within only two weeks (Fawcett & Okamura 1995; Okamura 1997; 'Hanshin-Awaji daishinsai to maizou-bunkazai' Symposium Executive Committee 2001). The devastated area, centred around Kobe city, was estimated to include approximately 250ha of land containing archaeological deposits and comprised 280 archaeological sites. Based on these figures, the cost and amount of work and personnel necessary for undertaking the archaeological investigations were quickly calculated. One month after the earthquake, the heritage management measures in the devastated area were put in place.

Initially, the media took a negative attitude to the rescue excavations which were seen as 'an obstacle to reconstruction'. Nevertheless, the Hyogo prefectural government decided that it would be a great loss, and a cause of later trouble and regret, not to undertake proper excavations, even in such a difficult situation. The national government, the Hyogo prefectural government, and municipal governments in the affected area issued a joint memorandum: 'Basic principles regarding cultural resource management related to restoration and reconstruction associated with the Hanshin earthquake'. This established some important principles.

In the case of the reconnection of essential utilities, such as electricity, gas, water and drainage services, as well as urgent reconstruction works, such as the construction of temporary housing and the removal of collapsed or burnt buildings and construction debris, the initiator of construction work was not required to report archaeological impact prior to construction, as required by the Law for the Protection of Cultural Properties. (The Agency for Cultural Affairs was to issue the same memorandum on 25 March 2011 for the Great East Japan Earthquake.)

The funding arrangements for archaeological excavation were revised. Before the earthquake, the government had subsidised excavation in advance of non-public construction projects only when the developer was a private individual. In contrast, after the earthquake the government agreed to provide excavation subsidies for small businesses, who would normally be asked to pay the whole cost as the initiator of a profit-making development.

A major problem was to find enough archaeologists. In June 1995, a restoration excavation team was established in the cultural properties office of the Hyogo Prefectural Board of Education specifically to undertake rescue excavations in the affected area. Between 1995 and 1997, 121 archaeologists working for regional governments (in many cases attached to the local education boards) from as many as 40 different prefectures, from Aomori in the north to Kagoshima in the south, were assigned to the team.

A total of 1600 investigations were undertaken prior to the construction of new houses, and 540 of these required thorough excavation of the areas to be developed. The total area investigated covered 189 000m^2. Many discoveries were of sufficient impact to alter understanding of local history, and as many archaeological discoveries were made in these three years as would normally be made in 20 years (Morioka 2011).

Unexpectedly, there was hardly any criticism, despite initial concerns on the part of the archaeologists. Instead, many favourable voices were heard, including requests by local communities for site open days and for cooperation with schools for students' independent study during summer vacations ('Hanshin-Awaji daishinsai to maizou-bunkazai' Symposium Executive Committee 2001: 82–89, 134–35). Several reasons can be put forward for this unexpected reaction, such as a shared norm of obedience to the law, generally positive sentiments towards those who are protecting the past, and the identity of those who live and had lived in the same site. Contrary to what might have been imagined at the outset, it also suggests that, on the ground, archaeological site investigations and the (re)construction of the city were not necessarily in conflict with one another.

One serious outstanding problem left behind by the project concerns the publication of the results of these successful rescue excavations. The excavators dispatched from outside Hyogo prefecture tended to be replaced every year, and a large quantity of unpublished data was left behind once the archaeologists who undertook the work had returned to their own organisations. A flexible approach to this problem would have avoided any ongoing difficulty, for example, by mandating the formation of a team comprised of both external assigned and local archaeologists for each excavation. Retrospectively, the objective of the missions could also have been set to include not only the efficient rescue management of the endangered sites but also their publication.

The response in 2011 (Okamura)

We had hoped that our experience with the Hanshin Awaji Earthquake could contribute to a repository of knowledge that would be of use in future such situations, to help communities affected by disasters of this kind cope, in particular with regard to archaeological heritage management. However, the situation was a lot more difficult this time.

First of all, the scale of the devastation was simply immense, with the affected area covering several prefectures, not just one city and its surrounding area as in the case of the

Hanshin Awaji Earthquake. Moreover, it is more difficult now for the Agency for Cultural Affairs to take the initiative for archaeological heritage management in the devastated area, due to the long-established governmental policy of decentralisation. Central leadership and coordination are especially important in this case.

Second, the economic situation is different. In 1995, although the economy had stagnated somewhat after the 'bubble' years of the late 1980s and early 1990s, it was still much better than today. As the market economy has further developed in Japan, and the individualistic mentality it has generated has infiltrated ever deeper into society, problems caused by increasing social inequality are made even worse. Japanese society itself seems more stagnant now than in 1995. This in part at least explains why it is hard to obtain any consensus for properly undertaking rescue archaeology investigations under emergency circumstances such as are now faced.

Third, it might be more difficult to assemble a sufficient number of excavation and conservation specialists to undertake the necessary task. Since the mid 1990s, in order to cut costs most local authorities have either stopped recruiting altogether or have recruited new heritage management officers much less frequently than in the past, resulting in an overall decline in the number of professional archaeologists across the country. This is compounded by local government reorganisation, which has led to the merging of many towns and villages for economic and demographic reasons. The devastated area is rich in sites not only of exceptional importance but also unique in character. Some of the best examples are the large numbers of shell midden sites, many designated as national cultural properties. Proper investigation of shell midden sites requires specialist knowledge, a high level of skill and the organisation of interdisciplinary collaboration. The above-mentioned problems may make it very difficult to assemble teams qualified to undertake such excavations.

Despite such extreme difficulties, the rescue of damaged cultural properties was organised very quickly and progressed at great speed. The Agency for Cultural Affairs immediately initiated a cultural properties rescue programme in order to prevent cultural properties, regardless of their being designated, undesignated or privately owned, from being neglected, disposed of, unwittingly sold to illicit traders, or even stolen, in the turmoil of the initial stages of the demolition of destroyed buildings and the removal of debris (Agency for Cultural Affairs 2011). In the devastated areas, ancient documents, ethnological and archaeological artefacts and the like are being rescued from damaged museums, archives, shrines, and individuals' homes, cleaned and given first-aid conservation treatments, including high-speed vacuum freeze-drying for water-damaged Japanese paper documents (Matsui 2011b).

The immensity of the task, however, remains daunting. Widening the scope of the rescue initiatives and more proactive and efficient organising of those involved in the task are still essential. The Society of Archaeological Studies, with about 4000 members coming mainly from western Japan, turned its annual assembly on 23 and 24 April 2011 into the 'Earthquake Disaster Forum', in which serious situations in the devastated area in Miyagi and Iwate prefectures were reported, and possible actions discussed. It was unanimously approved that the Society would continue informing its members of the rapidly-changing situation on the ground and would continue discussing potential action plans. The largest archaeological society in Japan, the Japanese Archaeological Association, also held a special session on the earthquake disaster and formed a special committee at its annual general

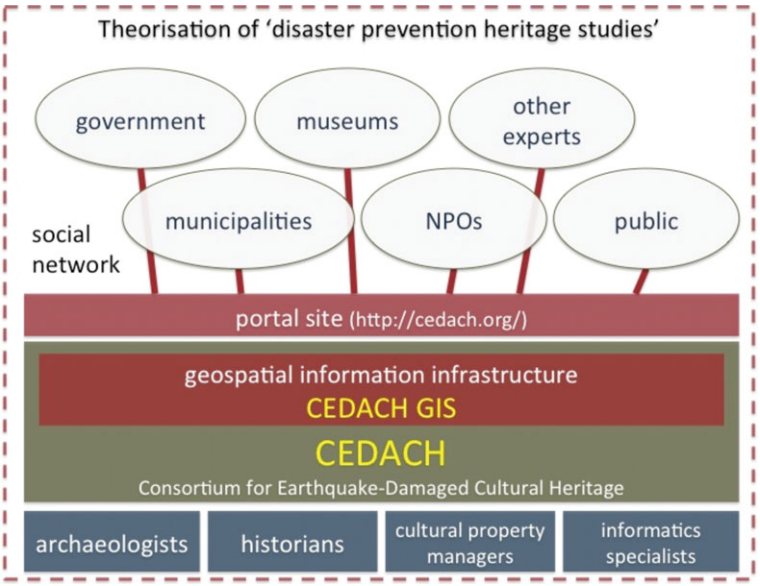

Figure 3. CEDACH: the schematic framework.

assembly on 28 May 2011. It was unanimously agreed at the meeting that members should proactively cooperate in the relief effort in the form of donations and participation in the rescue programme, and actively involve themselves in the reconstruction of the area by any means possible. The Association, under the name of the then president, Professor Tetsuo Kikuchi, issued a statement in the form of an 'Appeal for the proper conservation and investigation of cultural properties in the reconstruction process of the devastated area'.

The role of CEDACH (Kondo, Fujimoto and Uozu)

Less than two days after the Great East Japan Earthquake, a group of Japanese archaeologists, historians, and specialists in cultural informatics started discussing on Twitter and Facebook what they could do to assist. This spontaneous activity resulted in the formation of a Consortium for Earthquake-Damaged Cultural Heritage (CEDACH), formally established at an inaugural meeting on 21 March 2011. In April 2011, as the Cultural Property Rescue Project started conserving the damaged materials stored in the museums hit by the tsunami, some local authorities began to assess the feasibility of relocating the most severely damaged coastal settlements to higher ground, where a dense distribution of archaeological sites was predicted (see below). Fully aware of this situation, CEDACH offered a range of expert support for the documentation and restoration of the endangered cultural heritage, particularly buried cultural properties such as archaeological sites and materials, through the formation of: (1) a social network of experts; (2) a geospatial information infrastructure; and (3) a theoretical framework of 'disaster heritage studies' (Figure 3).

CEDACH developed an online/offline social network for connecting the specialists and institutions concerned. A portal website (http://cedach.org/) was created so that members and partners of CEDACH could share information (Kondo *et al.* 2012).

The agendas were intensively discussed in the meetings in July 2011 and March 2012, where guest speakers were invited from the disaster areas and other governmental and non-governmental organisations. Those meetings were a fruitful occasion to understand the current situations and needs of heritage management in the disaster area. With careful consideration of the emerging and changing needs, the data management team of CEDACH is developing an internet-based geographical information system, the CEDACH GIS, to assist documentation of the endangered heritage (Kondo *et al.* 2012). At the beginning of the project, a number of skilled volunteers and university students participated in checking the geo-coordinates of buried cultural properties in the nationwide database compiled and maintained by the Nara National Institute for Cultural Properties (http://mokuren.nabunken.go.jp/Iseki/). This project aims to supply reliable base maps for on-site damage assessments and investigations, which will be carried out by local cultural property managers alongside the CEDACH's technical support team, including those with experience in the rescue projects conducted following the Great Hanshin Awaji Earthquake in 1995, and other natural disasters.

Through the case studies in the disaster-hit areas, CEDACH plans to establish a new field of research, 'disaster-related heritage studies', in which the methods of conservation, risk management and education about heritage damaged by past disasters are systematised. As specialists in the historical sciences, we are responsible for properly informing the public of the fact that natural disasters have struck and brought devastations in the past. We also have an obligation to tell the public that people survived these disasters and went on to resurrect their lives. Based on these observations, we concluded that we need to study this new concept of disaster-related heritage as a form of cultural heritage that is psychologically connected to, and evocative of, the memory of past disasters.

CEDACH relies on and is supported by selfless and tireless *pro bono* contributions from colleagues who gathered together to support the restoration of the endangered cultural heritage in the disaster-hit areas with the aid of GIS. We believe the lessons being learnt from the experience in Japan are applicable for every natural and human disaster in the world. Therefore, CEDACH wishes to communicate with colleagues the world over, share information and experience, and exchange ideas.

Prospects (Okamura)

There are further heritage implications of the Great East Japan Earthquake. The Reconstruction Design Council set up by the Japanese government in April 2011 issued a statement in June 2011 to ease the planning regulations for land use, making it easier to relocate settlements on higher ground, free from future tsunami threats, rather than reconstructing the settlements on the same sites (http://www.cas.go.jp/jp/fukkou/english/index.html). However, this naturally affects the buried cultural heritage on the uplands: there are some 6000 known archaeological sites in Miyagi prefecture and 13 000 in Iwate prefecture. In the Sanriku region, more sites are located on the hills than on the coastal plains. Many Jomon period sites are situated in these upland locations, and the discovery of many more sites is expected. If, as anticipated, it is decided to relocate many settlements to the higher ground, the problem of how to conduct preventative archaeology on such an unprecedented scale will very soon

become a pressing issue, one that all those who are involved in heritage management and protection—not only in the devastated area but across the country—will have to face.

However, despite the unprecedented socio-economic turmoil and hardship, or possibly because of it, people are much more aware of the importance of communal support and solidarity than they were 16 years ago when the Great Hanshin Awaji Earthquake hit Japan. Moreover, the development and widespread use of information technology and social media have made grass-roots communication and collaboration much easier, contributing to the raising of awareness. Instant information-sharing through social media such as Twitter and Facebook supports the quick and efficient implementation of effective action, and platforms constructed through such social-media-aided communication, such as the GIS-based platform being constructed by CEDACH, have already begun working to gather and share various types of information concerning the current state of individual sites in the devastated regions (see above). This will be invaluable in devising a reconstruction agenda, striking a harmonious balance between investigation, excavations, development, and management of each site by taking into account the local context.

The new generation of archaeologists does not hesitate to make full use of such information technology tools, and has managed to visualise their on-going work through exchanging messages in open arenas in cyberspace, breaking down barriers between the inside and outside of stakeholder domains. Such communications, driven by altruistic enthusiasm to do something for the sake of the devastated area, the people affected and their heritage, have tremendous potential to attract wider attention and energise both official and grass-roots reconstruction activities. Regarding the support systems, far more volunteer groups and organisations have formed than at the time of the Hanshin Awaji Earthquake, and these continue to grow rapidly.

There are important research issues too. Just after the Great Hanshin Awaji Earthquake considerable attention was focused on 'earthquake archaeology', which investigated the traces of past earthquakes found on archaeological sites and tried to develop explicit measures to estimate their impact (cf. Barnes 2010). With the cooperation of some 150 archaeologists from all over Japan, a report was published the following year compiling the traces of past earthquakes excavated from 378 sites around the country (Maibun-kyuen renraku kaigi & Maizou-bunkazai kenkyu-kai 1996). The report generated much public interest, and was widely covered by the major national newspapers. However, as time passed, attention and interest have dissipated: the precious message put out through the mediation of archaeology has now been neglected and forgotten. Those of us practising archaeology in Japan all profoundly regret that we did not make enough effort to disseminate information concerning the traces of past great tsunamis discovered in sites such as Kutsukata (see above).

From the detailed investigation of the power and mechanics of the Great East Japan Earthquake and the frequency of aftershocks, some seismologists and geologists have begun arguing that the Japanese archipelago and the surrounding areas have entered a new phase of seismic activity. In addition, the ongoing disaster at the Fukushima No. 1 nuclear power station maintains a sense of impending crisis. It is therefore likely that the citizens of Japan are more prepared than ever to listen to the message from the past.

Japanese archaeologists should cooperate with all those who study the past and every scientific community to construct a repository of all types of information available

concerning past disasters and should strive to establish and promote a 'disaster archaeology'. This new field should be fully utilised for planning and devising disaster prevention measures, and initial and medium- to long-term response frameworks. The compilation of relevant data has already made great progress in certain areas around the epicentre of the Great Hanshin Awaji Earthquake. The next step is to begin sharing and explaining the accumulated data to the public, and to promote greater understanding of the importance of the field.

So soon after the earthquake we sometimes still feel at a loss in the face of the immensity of the task ahead. But this is no time to despair: it is time to draw on all of our available knowledge. Bringing together our understanding of disaster, heritage and archaeology, and thinking hard about how to improve our response: this is part of the destiny of Japanese archaeologists who have to practice archaeology in one of the most earthquake-prone countries on earth. In this we call for the cooperation and collaboration of archaeologists across the world.

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References

Agency for Cultural Affairs. 2011. Bunkazai resukyu jigyo [Cultural properties rescue program]. Available at: http://www.bunka.go.jp/bunkazai/tohokujishin_kanren/pdf/bunkazai_rescue_jigyo_ver04.pdf (accessed 18 July 2012).

– 2012. Damages to cultural properties in the 'Great East Japan Earthquake'. Available at: http://www.bunka.go.jp/english/pdf/2011_Tohoku_ver14.pdf# (accessed 18 July 2012).

Barnes, G.L. 2010. Earthquake archaeology in Japan: an overview. *Ancient Earthquakes: Geological Society of America Special Papers* 471: 81–96.

Fawcett, C. & K. Okamura. 1995. After the earthquakes: an examination of the implications of the Hanshin Earthquake for Japanese cultural resource management. Paper presented at the 28th Annual Chacmool Conference, 11 November 1995, Calgary, Canada.

Hanshin-Awaji daishinsai to maizou-bunkazai [Symposium Executive Committee]. 2001. *Shinsai wo koete: Hanshin-Awaji daishinsai to maizo-bunkazai shinpojiumu no kiroku [Go beyond the earthquake devastation: the record of the symposium 'The Great Hanshin Awaji Earthquake and buried cultural properties'].* Tokyo: Epic Corporation.

Kaner, S., J. Habu & A. Matsui. 2011. Rescuing archaeology affected by the Japanese earthquake and tsunami. *Antiquity* 85. Available at: http://www.antiquity.ac.uk/projgall/kaner329/ (accessed 19 July 2012).

Kondo, Y., A. Kaneda, Y. Fujimoto, Y. Seino, H. Yamaguchi & T. Uozu. 2012. The CEDACH DMT: a volunteer-based data management team for the documentation of the earthquake-damaged cultural heritage in Japan, in M. Zhou, I. Romanowska, Z. Wu, P. Xu & P. Verhagen (ed.) *Revive the past. Proceedings of the 39th Annual Conference on Computer Applications and Quantitative Methods in Archaeology, held at Beijing, April 12–16, 2011*: 326–33. Amsterdam: Amsterdam University Press.

Maibun-kyuen renraku kaigi & Maizou-bunkazai kenkyu-kai (ed.). 1996. *Hakkutsu sareta jishin-konseki [Excavated traces of past earthquakes].* Osaka: Maibun-kyuen renraku kaigi & Maizou-bunkazai kenkyu-kai.

Matsui, A. 2011a. Heritage rescue in the wake of the Great Eastern Japan Earthquake. *SAA Archaeological Record* 11.4: 11–15.

– 2011b. Higashi-Nihon daishinsai to Bunkazai-resukyu [The Great East Japan Earthquake and heritage rescue]. *Nabunken News* 42: 1. Available at: http://repository.nabunken.go.jp/modules/xoonips/detail.php?item_id=1650 (accessed 19 July 2012).

MORIOKA, H. 2011. Daishinsai to fukko wo mezashita iseki-chosa: 16-nen mae no kaiko to sonogo no ayumi [The Great Hanshin Awaji Earthquake and rescue excavations for the reconstruction of the devastated area: recalling 16 years ago and reflecting the process thereafter], in Kokogaku kenkyu-kai [Society of Archaeological Studies] (ed.) *Kokogaku kenkyu-kai dai 57 kai sokai shiryo [Proceedings of the 57th Annual Meeting of the Society of Archaeological Studies]*: 17–31. Okayama: Society of Archaeological Studies.

OKAMURA, K. 1997. Sinsai-go no maizo-bunkazai no chosa [Post-earthquake rescue excavation of buried cultural properties]. *Asu heno bunkazai* 39: 19–34.

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