TOURISM AND ARCHAEOLOGICAL HERITAGE

Driver to development or Destruction?

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Abstract. Some of the most scientifically and historically important, aesthetically spectacular, and famous archaeological World Heritage Sites have seen a dramatic increase in numbers of visitors over recent decades. The ICOMOS International Scientific Committee on Archaeological Heritage Management (ICAHM) has begun evaluations of how greatly increased visitation has affected historical and scientific values at four such pre-eminent sites (Petra, Machu Picchu, Pompeii, and Angkor) and the social and economic conditions in nearby communities. Our preliminary findings indicate that inadequately regulated and managed tourism has undermined the outstanding universal value of some of, if not all, of these sites, and that the unbalanced attention paid to the economic benefits of tourism has not advanced the agenda of the World Heritage Convention, but instead threatens it.

At many archaeological World Heritage Sites, global media have reported significant deterioration of site fabric or social disruptions that have been linked to over-visitation. Further, while much has been made of the economic benefit to countries in which archaeological World Heritage Sites are located, preliminary research by ICAHM has yielded only anecdotal indications of the magnitude of such benefit, and no reliable data regarding the parties to which benefit has accrued. Nonetheless, at each of these sites, tourism has been promoted through investments made by international assistance programs, including USAID and JICA, and some host countries have been the recipients of loans from lending institutions such as the World Bank and the Inter-American Development Bank.

We contend that archaeological sites and landscapes comprise a type of cultural resource that must be managed in special ways in order to preserve scientific and historical values. This paper will present the information that we have examined and explain the reasoning that we have in developing this position.

If tourism is not carefully and effectively managed at areas that contain archaeological materials, the scientific and historic values that can be realized only through the careful study of those materials will be lost irretrievably with the material itself. This is not speculation; there is ample evidence that the archaeological record has become increasingly compromised in recent decades as numbers of visitors to archaeological sites have grown. Figure 1 displays the increase in visitation at Petra over past decades. Although reliable estimates of increases in tourism have been difficult to obtain for Machu Picchu and Angkor, numerous anecdotes indicate that visitation at those sites has increased even more than at Petra. Archaeological materials include the archaeological sites and landscapes that everyone recognizes as such, Petra, Machu Picchu and the like, and also what has been called "the city below the city," archaeological resources found below ground in historic cities around the world, from Rome to Quito. Tourism and attendant development of faculties for tourists has also dramatically increased at such cities in recent decades.

The ICOMOS International Scientific Committee on Archaeological Heritage Management (ICAHM) is preparing a series of publications that examine how this greatly increased visitation has affected historical and scientific values at four of the most famous archaeological World Heritage Sites, Petra, Machu Picchu, Pompeii, and Angkor. The first of these publications has just been printed and is available now. Because social changes in nearby communities are related to threats to archaeological heritage, the studies will also deal with how tourism has altered social and economic conditions in nearby communities.

What can not be overemphasized is that the scientific and historical value of an archaeological site or

landscape depends upon the preservation of both original material and the context within which it is found. Inadequately managed tourism damages material and context in many ways. Among them is development or other destructive activities inside the site and within the containing landscape. Material is destroyed during construction of buildings, roads, and installation of utilities. Material is also destroyed as tourist move through the site. In the absence of barriers, material is lost by abrasion, or damaged and disorganized as tourists climb on ancient structures, or altered and ultimately lost as the temperature and humidity fluctuates in enclosed spaces.

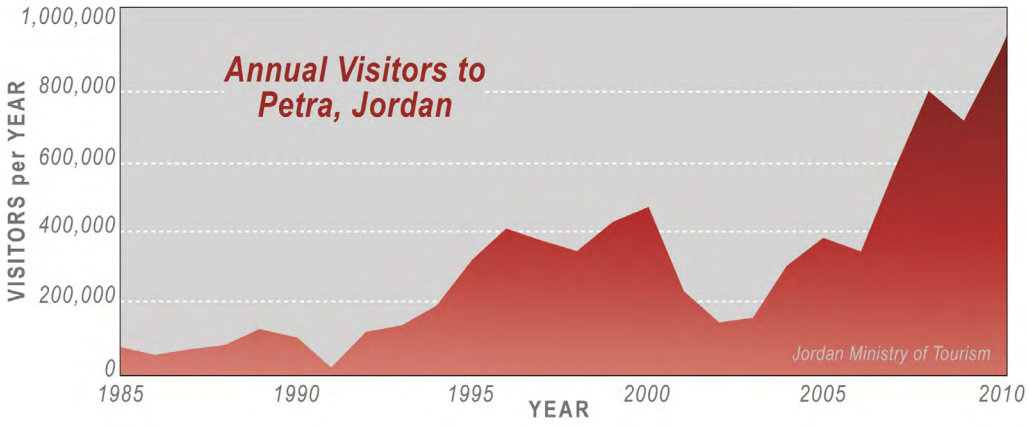

Figure 1: Annual Visitors to the World Heritage Site of Petra, Jordan, from the time of its inscription on the World Heritage List in 1985 until 2010. Figure by Thomas Paradise.

Attrition of the Archaeological Heritage

Damage by development can be immediately massive as when large construction projects are undertaken in areas that contain archaeological materials. Equally severe damage may occur insidiously, however, as damage from many small projects or actives that are incompatible with the preservation of archaeological materials continue. Examples of the latter include installation of wiring for sound and light shows by cutting channels in ancient stonework, or backing tourism vans or delivery trucks into ancient columns or friezes. The authors have been present on numerous occasions when such incidents have occurred, which suggests just how frequently this happens. Some of these incidents have made their way into the international press. At Machu Picchu in 2000, the monument referred to in English at the Tether of the Sun was chipped during the filming of a beer commercial by the American advertising company J. Walter Thompson. Peruvian archaeologist Federico Kaufmann Doig, was reported in many news outlets at the time to have said, "Machu Picchu is the heart of our archaeological heritage and the *Intihuatana* is the heart of Machu Picchu. They've struck at our most sacred inheritance. This is an affront to our ancestors."

One might be tempted to dismiss a single such

Figure 2: Photo of chip made on the Tether of the Sun at Machu Picchu during filming of a beer commercial. Photo by BBC News Service http://news.bbc.co.uk/2/hi/americas/923415.stm

incident as inconsequential, but if steps are not taken to prevent more from occurring again, they will. The cumulative effect can be devastating. Tourism is the catalyst for degradation of the archaeological record in many ways.

Visitor Flow and the Erosion of Archaeological Fabric

Erosion of stone monuments by human abrasion exacerbated by humidity and temperature fluctuations, although gradual, can be very substantial. Figure 3 is taken from Chapter 3, by Prof. Thomas Paradise, of the first of the four publications mentioned just above, *Tourism and Archaeological Heritage at Petra: Driver to Development or Destruction?* (2011). As Dr. Paradise has documented; loss of archaeological material associated with the movement of tourists through sites is often accelerated by careless management of visitor flow. In an effort to move more visitors through the site, inappropriate means are sometimes put in place by site managers or simply allowed to develop on the initiative of local vendors. An example of this is the damage produced by the hooves of donkeys as they carry tourists up and down the steep Nabataean steps that lead to Ad-Dayr, one of the most beautiful tombs at Petra. Thousands of such trips have pulverized the original material from

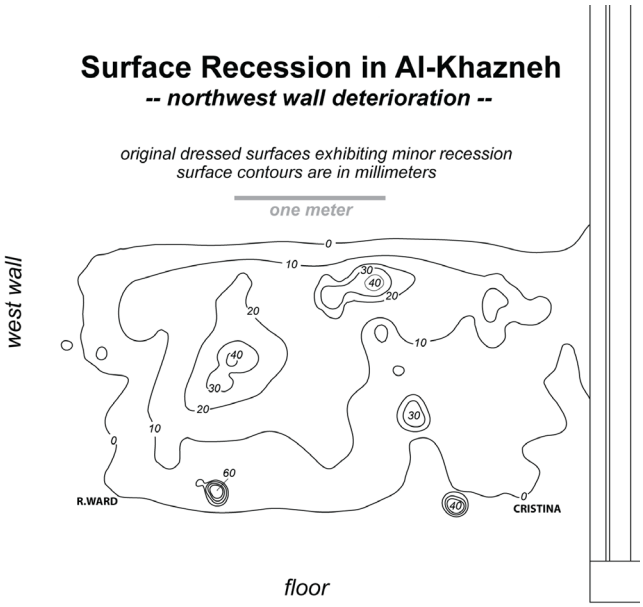

Figure 3: Map representing the surface of the northwest wall of the inner chamber of al-Khazna. These cavities and areas of surface recession indicate where most tourist groups have leaned against the wall, causing substantial erosion from abrasion (feet, hand, head, and derriere). The words "R. WARD" and "CRISTINA' are deeply gouged graffiti in the wall. The numbers represent surface recession (mm) measured from the originally-dressed sandstone surfaces found along the same wall but below and above visitor abrasion. These dressing toolmarks were created 2,000 years ago by Nabataean stonemasons. Map by Thomas Paradise, from his research on stone deterioration at Petra.

which the steps were made (Figure 4).
Allowing vehicles to enter the site will ultimately produce damage. Accidents will occur, as noted above. Even if roads are not constructed, eventually ruts will be formed by vehicular traffic and maintenance will be needed. Pressure will mount from those who are not allowed to bring vehicles on site and if management yields to this pressure, maintenance of frequently used routes creates de *facto* roads. It is axiomatic that nothing encourages further development like a road. As traffic increases, vendors will press for the opportunity to provide services and products to those using the road. What begins as casual vending often ends with the construction of facilities. Further, motorized vehicles pollute. Fumes can react with masonry in ways that destroy stone, or at the least interact chemically with it in ways that include discoloration.

Other means of moving more visitors rapidly into and through a site are by means of funiculars and aircraft. While discussion of the adverse effects produced by these means of conveyance usually centers on how incompatible they are with the experience desired by visitors to an ancient site, each also damages material at the sites at which they are put in place. Funiculars must be constructed and maintained. This requires constructing roads, which might initially be intended to be temporary, but are often reused when maintenance is required, and then become de facto routes used by management or by special visitors. If the number of visitors given special recognition increases, so

Figure 4: The long, processional stairway that leads to Ad-Dayr at Petra has been almost completely destroyed by the feet of donkeys carrying tourists. Photo by Douglas Comer.

too does use of the road. That number will inevitably increase with increases in overall visitation.
Aircraft over-flights are a potential cause of damage to archaeological sites with structures. A United States National Park Service study provides the following information:

SHORT TERM EFFECTS. A short term effect is one in which one or two noise events are sufficient to produce a permanent displacement in a structural element. A collapsed roof, or a broken window are dramatic examples of acoustic pressure loads that are capable of producing structural failure or a major compromise to structural integrity in only a few flexure cycles....
LONG TERM EFFECTS. More insidious are the long term effects created by repeated exposures at lower acoustic levels. While the dramatic effects of sonic booms can result from only a few, large-amplitude pressure cycles, equal damage can be accomplished with greater numbers of lower amplitude pressure cycles (a single helicopter hovering for 30 seconds with a blade passage rate of 12 per second would produce 360 pressure cycles). In contrast to a major structural displacement, the smaller pressure cycles may initiate a slower process consisting of three stages: 1) fatigue cracking, 2) moisture damage, and 3) erosion damage. The lower amplitude acoustic pressure cycles can initiate fatigue cracking....
Once fatigue cracking has begun, nature can complete the damage without further assistance....

Trails

Trails that take visitors away from the main areas in an archaeological site open them to all manner

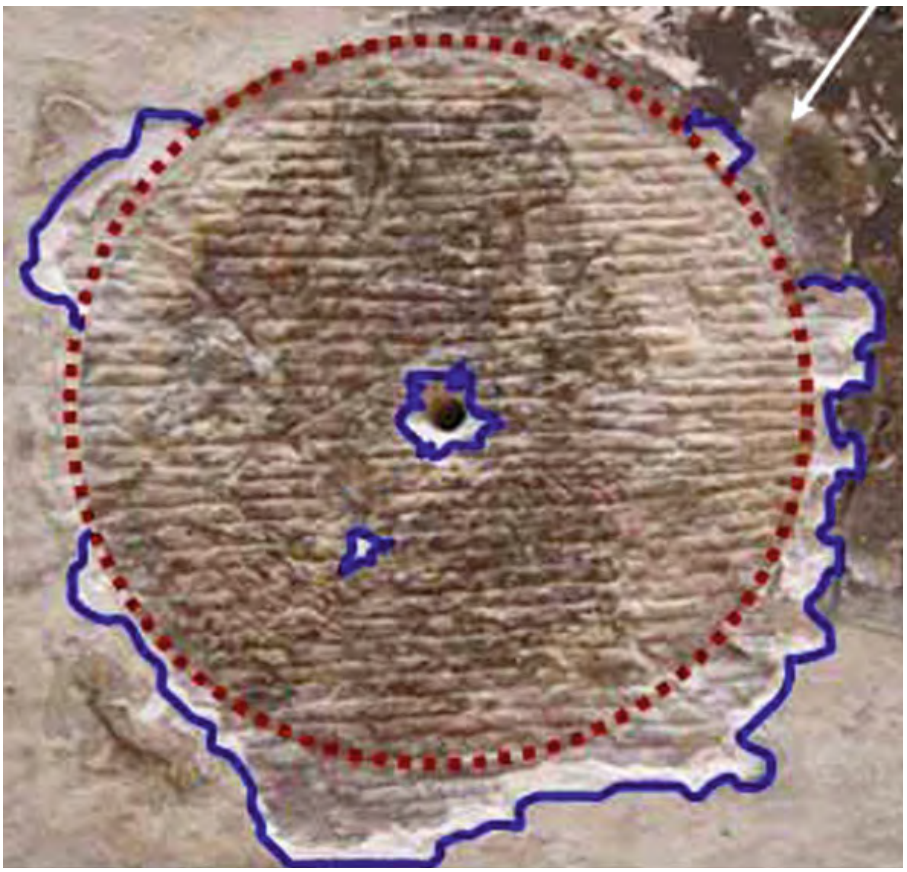

Figure 5: Evidence of attempted theft of central medallion at Biclinium 849. Photo by Courtauld, Courtesy the Petra National Trust and Aysar Akrawi.

of abuse. Sales to tourists of what are represented to be coins, potsherds and lamps are common at Petra, especially when tourists take paths that lead them away from the most heavily visited areas. While there is a cottage industry in the production of fake antiquities, there is also a thriving trade in the sale of authentic ones to discerning buyers who recognize the forged antiquities for what they are. Arrangements for the sale of real antiquities to interested parties who have refused to purchase replicas that have been treated in ways that simulate the patina of age are most easily made out of view of Petra Archaeological Park employees and other visitors. Among these, often, are coins taken from contexts in which, had the location been carefully documented by archaeologists, they might have provided important dates. The backcountry trails are ideal venues for this, and so encouraging visitors to take these trails has encouraged looting at Petra.

Trails and trail maps not infrequently leave tourists disoriented, lost in conditions of extreme heat or cold, and lured into areas of difficult terrain, where they fall and are injured or killed. The dangers are made worse by the fact that many visitors to archaeological sites are elderly. Inevitably, too, away from the eyes of fellow visitors, some local residents offer to sell illegal antiquities to tourists. At Petra, isolated tombs and structures are used as ad hoc restrooms by those who have become lost. This is not only highly unpleasant to subsequent visitors, but is damaging to paintings, frescoes, and the stone from which the tomb was carved.

Events

Iconic archaeological sites provide highly desired backdrops for events of all kinds. Many an archaeologist is familiar with enthusiastic proposals to stage concerts at an archaeological site where she or is conducting research, along the lines of the well-known Three Tenors Concert of 1994 held at the Baths of Caracalla in Rome.
While a single event can cause damage as lights, equipment, and the stage are put into place, multiple events will almost surely produce real destruction. At Petra, despite vocal and repeated objections by groups advocating for the protection of the archaeological heritage there, perhaps most notably the Petra National Trust, numerous events have been staged. These include weight-lifting contests, marathons, receptions of many sorts, dinners among ruins, filming of commercials and movies, musical performances, and rallies. Figure 6 is a photo of a rally held in the Petra Theatre, where long-term studies had established that many ancient mason's marks had been obliterated by the friction on risers of tourists seated there, and more were endangered by this practice.

Unthoughtful Development Around Archaeological Sites

Even more severe destruction can be precipitated by development around archaeological sites that alters the environment in ways that accelerate processes that damage sites. Those resources that make a site of scientific and historic al value, and which render it eligible for inscription on the World Heritage List, exist because that have been sustained by the status quo of environmental and cultural systems. Development, including development driven by tourism, alters those systems.

Hydrology is a factor in all manner of human occupation of the landscape. Humans require water and over time have developed ways to manage the flow of water so as to acquire and store what is needed and to prevent water from damaging what humans have constructed. Again, we can use Petra as an example. The terrain around Petra is steep, but amenable to terracing. Rainfall was never great, but the Nabataeans, who built the ancient city two millennia ago, had learned to harvest and store rainfall in the harsh conditions of the Arabian Desert. They built dams across wadis and rock slopes to direct water into channels and thence to cisterns and reservoirs. The water was used for public wells and baths, the private homes of the wealthy, in temples and public structures, for industries of various types. It was also used in agriculture, not the just the growing of grain, but also watering figs, grapes, and herds of goats.
The flow accumulation model seen in Figure 6, based on a surface model developed from Satellite and aerial imagery, assumes an annual rate of precipitation that is the same as that as today, about 200 millimeters. Occupants of cities in the ancient world utilized about 0.6 cubic meters of water per person per day, a much larger volume than that consumed by the prehistoric occupants of the area, to be sure, because of the many more uses to which water was put in Hellenized or Roman cities. If 16.5% of the annual precipitation falling within the catchment seen in Figure 6 were captured, this would be enough to support a population of 30,000 using 0.6 cubic meters of water per day. Water obtained from springs would be in addition to this.

The water management system created by the Nabataeans has fallen into disrepair; in fact it is more accurate to say that it has been destroyed in key areas by tourism-related development upslope from the ancient city.

Figure 6: Rally in 2007 for the New Seven Wonders of the World in the Theatre, which had been cordoned-off from visitors for years following studies that found that many of the inscriptions in the theater had been worn away by visitors taking seats there. Photo courtesy the Petra national Trust and Aysar Akrawi.

Instead of channeling and buffering water flow during precipitation events, this development has created an environment in which flooding is more likely to occur.
In 1987, shortly after Petra was inscribed on the World Heritage List, there were only a few hotels in Wadi Musa, the community upslope from the ancient core of Petra. Today, there are more than 100, with the attendant roads, parking lots, restaurants, and other buildings, all of which create surfaces impervious to water. Consequently, the velocity and volume of water that makes its way into the ancient city has increased correspondingly. Figure 7 illustrates this clearly, showing the effect of a torrent of water that rushed through the lower reaches of the town of Wadi Musa just above the entrance to the Petra World Heritage Site. Because of rapidity with which the flood developed by virtue of the impervious surfaces in the town above, two young men walking alongside the road in the photo were drowned, their bodies washed into the core of the ancient city below.

When the flow of water reaches the tombs, structures, and buried archaeological materials in the World Heritage Site, it does great damage. Water is an agent of erosion, and fast flowing water erodes rock more quickly than does slow moving water. Any material carried in the water increases friction and if heavy enough can cause additional damage simply through the impact of striking rock faces. Cracks in rock faces provide access for water to softer stone beneath the crust that forms on sandstones at Petra, which eventually results in the spalling away of the outer surface of rock. Another way that water destroys the monuments at Petra is by carrying salts and other mineral to them. Even slow moving or pools of water can cause major damage in this way. Water containing destructive materials is wicked up into stone. The effects can be seen in Figure 8.
Note the distinctive keyhole shape of the tomb entrances. More stone is lost at the bottom of entrances because more water is absorbed there and the surface of the stone undergoes a wet dry cycle.
Flooding affects not only the monuments, but also sub-surface archaeological deposits. After major rain events, wadis suddenly appear in the heart of Petra where there were none the day before. These can be several meters in depth. They disappear quickly, filled in by earth moving equipment, which of course further disturbs sub-surface archaeological deposits. Therefore, while such episodes of flooding, erosion, and cutting and filling affect tourism very little because they occur only a few days out of a year and perhaps in some years not at all, they do irreparable damage to the archaeological record.

Broken Windows

In all of the examples of tourism related damage

Figure 6 : Landscape surface model of Petra region. Water accumulates within the area of the red rectangle, which contains most of the famous monuments of Petra.

presented above, the “broken windows theory” comes into play. As famously argued by Harvard professors James Q. Wilson and George L. Kelling (1982), the visual environment provides signals that establish norms, that is, people will behave in ways that are suggested to be normal and acceptable according to what they see around them. Wilson and Kelling
use not only broken windows but also graffiti as an example. In assessing the effect of graffiti, they quote Glazer, who says that graffiti communicates “the ‘inescapable knowledge that the environment …is uncontrolled and uncontrollable, and that anyone can invade it to do whatever damage and mischief the mind suggests’." Similarly, once development that mars the ancient landscape is allowed, other incompatible development becomes more imaginable and finally unremarkable. To those who work and live in an area, incompatible development becomes and accepted part of the scenery, to some extent it is no longer seen by them as they address the concerns of daily life. The same developments to a visitor expecting an experience these same developments can be jarring. Ultimately, though, both those who live and work at a site and those who visit a site will assume that since intrusive development is present, other intrusive development is acceptable. They are therefore relieved of their own responsibility not to introduce incompatible elements. If there are economic motivations to so, or if it is simply more convenient to do so, the introduction of incompatible elements becomes more likely. What is even more dangerous is that the cumulative effect of incompatible development progressively relieves all, residents, workers, and visitors alike, of the responsibility not to damage the site in other ways, and the sense of stewardship that should be felt by residents and those involved in site management and should be imbued in visitors, which is necessary to the long-term sustainability of the site, is lost.

Figure 7 : Rainwater rushing over the .impervious surfaces in the town of Wadi Musa produced this damage in the lower reaches of town. Two young men walking along this road were drowned, their bodies washed into the core of the World Heritage Site. Photo by Douglas Comer.

Figure 8 : Effect of salt-laden water wicking into sandstone is visible here. This kind of damage occurs from the ground up. Note keyhole shape of tomb entrances. Photo by Douglas Comer.

Tourism

Tourism at archaeological sites has been shown to drive destruction of archaeological materials at those sites. Repair of those materials does not undo the destruction. Inscriptions, frescoes, carvings, and other informative details of standing structures that are part of the archaeological record once gone are gone forever. The information that a coin could provide about the chronology of an archaeological site is lost for all time when the coin is excavated from its stratigraphic context by a looter.

The idea that documentation can make up for this loss is questionable and highly problematic. Documents are lost or destroyed over time, and digital records in the end might prove less durable than paper ones. In the years since computers have come to be commonly used we have seen great changes in storage media and the hardware used to view digital records. In the absence of a sustained program to update digital records, they will eventually become unusable. Programs come and go with the organizations that initiate them, and also with changes in the world economy and political stability. Also, digital media can be lost or destroyed as surely as are paper documents.

In the enthusiasm for tourism, the gradual, irreversible, and finally catastrophic loss of archaeological material in the absence of established and effective management is usually overlooked in favor of what are generally thought to be the great economic benefits that are realized from tourism. According to the World Travel and Tourism Council, "...the total contribution of Travel & Tourism to GDP, including its wider economic impacts, is forecast to rise by 4.2% pa from US$5,991.9bn (9.1% of GDP) to US$2,860.5bn (2.9%) in 2021 (in constant 2011 prices). (http://www.wttc.org/). An organization called Trade Wings, which identifies itself as India's premier institute for education in tourism and travel, offers the information that tourism produces 10.% of the word's gross national product. Is says also, "The most significant feature of the tourism industry is the capacity to generate large scale employment opportunities even in backward areas, specially to women, both educated and uneducated." (http://www.tradewinginstitute.com/world/more.htm)
While not usually couched in just these terms, the idea that tourism can provide employment opportunities to those with little formal education is widespread. Tourism has been embraced by many cities in the United States over past decades as businesses have moved to suburbs, leaving those not affluent enough to follow behind. This group has often not acquired as much education, and because of reduced tax revenues, opportunities in urban areas for further education often declines.
In places where economic growth is slow or has only recently begun, tourism holds the same appeal, that of "instant jobs," and a platform from which to build an economy. The promise of economic development and social well-being that is proclaimed by many to stem from tourism is often powerful enough to eclipse concerns about the sustainability of all cultural and natural resources, including archaeological ones.

Clearly, the priorities of many development organizations rate tourism before anything else. As one indication of this, a 2003 USAID report entitled “A Strategic Approach to Doubling the Tourism Economy of Jordan, 2004-2010," states that, "“Iconic heritage

and landscapes have a unique role as keystone building blocks of quality visitor experiences and powerful motivators supporting tourism marketing success." It goes on to say that, "Jordan's policy of combining tourism and antiquities, and now crafts in a single Ministry is widely admired internationally. … In other countries divergence between these groups can create major access and operational difficulties for tourism industries with a heavy reliance on heritage."[F]

At the same time, tourism has been criticized by many as providing only jobs in which skills developed are not transferrable, and as providing economic benefits for the most part to large and often international hotel, restaurant, and tour companies (Leiper, 1999; Faulkenberry, et al., 2000).

The Way Forward

It is ironic that effective archaeological heritage management would bolster economic revenue and enhance social benefits associated with tourism at archaeological sites. This could be done by attending to a simple metaphor, that of flow.

The flow of people through an archaeological site or landscape can nurture or destroy it depending upon how it is managed, just as the flow of water nurtured the ancient inhabitants of Petra, but threatens to destroy the monuments there today. Water made human life at Petra possible in ancient times because it was managed logically and effectively. Today, water is a destructive force at Petra, an imminent and serious threat to the existence of the tombs for which Petra is famed because of the impervious surfaces created by development upslope. We have seen how that water introduces dissolved salts into the sandstone from which tombs are carved. When the water dries, it forms crystals that expands and force apart grains in the sandstone, making it crumble. Water also finds its way into cracks produced by percussion or by alternate heating and cooling on the thin, brittle surface that forms on sandstone. It erodes the softer stone beneath, causing the shell to spall away. During flash floods, large volumes of water moving at high velocity erodes sandstone, and carries material that strike and damage the monuments. The floods also erode soils that contain archaeological deposits, destroying the context that is essential to interpreting subsurface

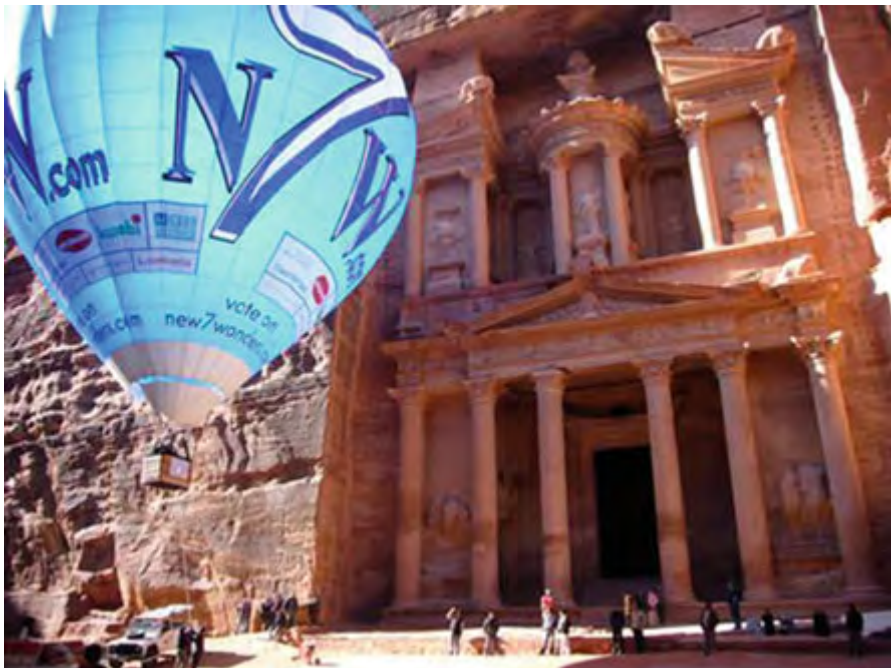

Figure 9 : Hot air balloon in the courtyard of Al-Khazna promoting Petra as one of the New Seven Wonders of the World in 2007. Photo courtesy Aysar Akrawi and the Petra National Trust.

remains. Water damage is a systemic problem that would best be addressed by altering the flow upslope from the ancient monuments. In the past, speculative treatments at individual monuments have largely accelerated destruction. Figure 10 displays the result of one such experimental treatment.
Technology now exists to produce a precise, high-resolution surface model that could be used to intervene at elevations above the ancient city, channeling water away from tombs, monuments, and subsurface archaeological sites. While this is imminently possible, carrying out such a project would require an integrated and effective management structure.

In many ways, the movement of great numbers of tourists through Petra produces similar results. Tom Paradise describes in detail in Chapter 3 of *Tourism and Archaeological Heritage at Petra: Driver to Development or Destruction?* (2011) how visitors produce abrupt changes in humidity inside tombs and Figure 9. Hot air balloon in the courtyard of Al-Khazna promoting Petra as one of the New Seven Wonders of the World in 2007. Courtesy Aysar Akrawi and the Petra National Trust.

have abraded sandstone in tombs and at the Petra theater. Anyone can see how visitors lean against and sit on ancient walls at Petra. Visitors also provide a market for illegally acquired antiquities.

Both the flow of water and that of visitors, then, can be beneficial to the preservation of the site or can produce grave damage to it. The difference is in how the flow is managed. If flows are regulated properly, the site will prosper. If not, ultimately the site will be destroyed, not only in terms of its scientific and historic value, but also in terms of its aesthetic and economic values.

Archaeological sites and landscapes should be conceptualized not as recreational parks, in which many people are enticed to spend great lengths of time, but as a museum or a laboratory. Visitors must made aware of the fragile nature of the antiquities there and provided opportunities to learn more and enjoy related experiences outside the area of archaeological importance. A visit to the site should be the touchstone for interpretation; interpretation itself should occur for the most part at places that do

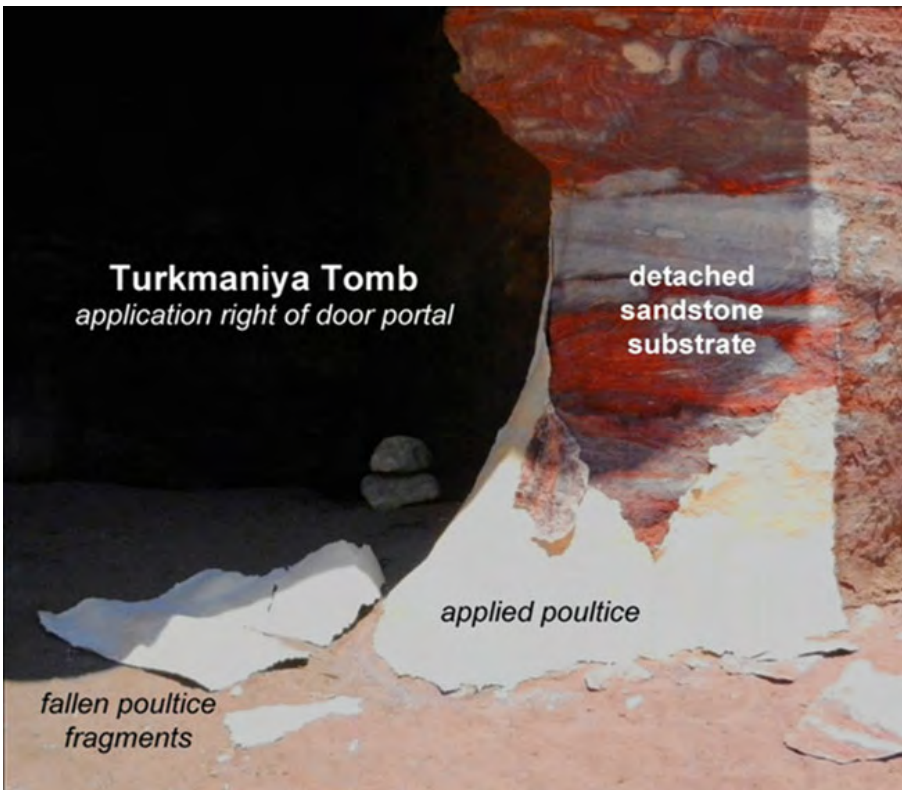

Figure 10 : Unsuccessful, experimental treatment to arrest sandstone deterioration at the Turkmaniya Tomb in Petra. Photo by Thomas Paradise.

not contain fragile resources, and where local communities have been or will be established. This will be essential for the preservation of the site, but will also yield substantial economic benefit to the communities within which interpretation and services are provided. Visits to archaeologically sensitive areas should be relatively short and the flow of visitors should be regulated so as to eliminate torrential flows that force individuals against antiquities, encourages people to clamber on ruins, and generates frustration and confusion that can impel people to other thoughtless, destructive acts.

Against the runaway obliteration of our archaeological heritage there are precious few global defences except the World Heritage Convention. The World Heritage List can play an important role in implementing the Convention if it protects places especially important to our common human history and if it provides models of excellence in the management or archaeological heritage. This can only be done if preservation is the first priority. The onus must be on tourism to establish that it can contribute to preservation and not threaten it before it is permitted at World Heritage Sites.

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