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Are fossils enough? Palaeontological tourism based on local dinosaur discoveries

Abstract: Fossils of dinosaurs and other tetrapods have long aroused interest of scientists and the public opinion alike. Every finding of a new (especially large) species receives coverage in national and international media, and thus, local fossil discoveries might constitute a good basis for local tourism development. The paper aims to examine whether fossiliferous sites on their own may be enough for the development of palaeontological tourism to occur, or do they require the support of additional amusement infrastructure. For this purpose, the interest in chosen localities was analysed using Google and Wikipedia searches, and was further discussed against a survey on dinoparks and their elements. The above-mentioned data reveal that local tourism can be indeed predicated on local paleontological findings, however, it is deemed considerably more efficient if such attractions are backed with an extensive infrastructure of amusement theme parks.

Keywords: theme parks, dinopark, tourism development, paleontological tourism, fossil

1. Introduction

Dinosaurs have attracted people's attention through the discoveries of new species since the first restorations of their monstrous apparition made by Gideon Mantell in 1832 (Górnicki, 2017). Particularly large specimens continue to stimulate our imagination as the scientific discoveries degraded dragons into legendary, fictitious animals (Bodzioch and Wężowicz-Ziółkowska, 2016). Moreover, dinosaur, similarly to other prehistoric organisms, occupy a significant place in our culture owing to numerous TV show, documentaries, books, gadgets, and toys, including such famous franchises as *Jurassic Park (World)* (Carvalho and Da-Rosa, 2008; Górnicki, 2016; Newsome and Hughes, 2016). Dinosaurs – understood as non-avian dinosaurs (i.e. all dinosaurs excluding birds, the only group which survived the end-Cretaceous mass extinction event) (Brusatte et al., 2015a) are also an important part of palaeontological tourism.

Palaeontological tourism is a type of scientific tourism, or ecotourism, related to geotourism (Gaworecki, 2003) and the history of life on earth (Da-Rosa, 2008). Tourist destinations in palaeontological tourism include parks, trails, routes and excavations sites, all of which become a factor of both economic and social development of the areas involving the discoveries and preservation of scientifically valuable sites and specimens (Schwanke and Silva, 2004; Wójtowicz et al., 2011).

Fossiliferous sites are regarded as „natural cultural monuments" (Carvalho and Da-Rosa, 2008), and as such should be regarded as places of great importance not only for scientists but also for local communities (Avila et al., 2016). They offer unique insights into the geological and biological history of a given region (Canudo, 2012; Tomić et al., 2015). Geosites featuring traces of past volcanic activity or invertebrate fossil-beds are usually a part of tourist routes or geoparks (Woźniak et al., 2010; Avila et al., 2016),whereas vertebrate remains may become tourist attractions on their own. Mass media willingly and frequently evoke and depict one particular period in the Earth's his-

tory, that being the end of the Mesozoic and the Cretaceous/Paleogene extinction event, which was plausibly caused by massive volcanic eruptions resulting in Deccan Traps (Schoene et al., 2015) and the meteoroid impact at the Yucatan Peninsula forming the Chixculub Crater (Alvarez et al., 1980). The unabated interest in dinosaurs paired with steady development of the tourist market and the increasing importance of new tourist trends (Kruczek, 2012), such as green tourism and geotourism (Wójtowicz et al., 2011; Zieliński and Janeczko, 2016), render palaeobiological attractions and fossiliferous sites featuring remains of Mesozoic archosaurs particularly popular for an average tourist.

Palaeobiological and, in particular, dinosaur tourist destinations can be divided into several categories:

a) Dinosaur attraction devoid of a fossil base, i.e. theme parks in random locations;
b) Museums gathering fossils from various locations;
c) Individual fossiliferous sites (unsecured nor legally protected);
d) Fossiliferous sites featuring additional attractions (e.g. theme parks based on local discoveries).

This paper focuses on the two latter categories related to fossil findings in the context of local palaeobiological discoveries.

The example of mammoth findings in Serbia (Tomić et al., 2015; Nikolić, 2019) shows that the discovery itself does not necessarily ensure large-scale interest of public opinion, and in order to attract more attention it requires proper exposition (Hose, 2000). This paper aims to establish how properly presented local fossil remains can contribute to local tourism development and what is the difference between the two types of tourist destinations– fossiliferous sites with and without additional infrastructure (gastronomy, cinemas, playgrounds, life-size dinosaur models).

2. Methods

The significance of these places with regard to tourist traffic is demonstrated with the use of a graphic representation of Internet traffic and the results of a survey conducted by the author.

Interest in given destinations was measured by a number of searches in Wikipedia (usingwmflabs.org tools), and Google (using Google Trends). The number of searches was compared for the analysed sites within certain periods of time (e.g. since the opening of a dinosaur park). In addition, paleontological sites were compared with other local tourist destinations of similar size that do not feature any paleontological attractions.

Results obtained from Wikipedia demonstrate the absolute number of hits, while Google Trends shows the number of searches in relation to the highest point in the chart. And thus, value 100 means the highest popularity, value 50 represents a phrase twice as popular as value 1, whereas value 0 indicates insufficient data for the given word.

The survey performed for the purpose of this study pertained to the importance of additional infrastructure for fossil sites. The survey was anonymous, conducted via an Internet form. The respondents were non-specialists (non-palaeontologists), 20 females and 36 males, including 6 under-ages. The respondents were to answer the following questions:

1. What kind of palaeontological tourism destination would you be more inclined to visit: a site of paleontological discoveries (example: fossilized dinosaur track site) or a dinosaur theme park (life-size models, playgrounds, restaurants, cinema);
2. What kind of palaeontological tourism destination would you be more inclined to visit: a) a dinosaur theme park (life-size models, playgrounds, restaurants, cinema) without paleontological specimens or b) dinosaur theme park based on local discoveries exhibited along with dinosaur models;
3. Arrange the following attractions from the most important to the least important: A) dinosaur life-size model, B) real fossils (e.g. mounted skeletons), C) real fossils in situ (exhibited at the place of a finding – bones or tracks at an excavation site), D) playgrounds, cinemas and restaurants.

The survey also allowed for some additional comments and included metrics (sex and age of the respondent).

Several sites were taken into consideration to achieve these aims:

1. Sites with additional attractions – Lourinhã (Portugal), Moab (Utah, USA), Krasiejów and Bałtów (Poland) (Fig. 1).
2. Sites without complex additional infrastructure (dinosaur theme parks) – Algarve (Portugal), Dakota Hogback (Colorado, USA), Sołtyków (Poland) (Fig.1).

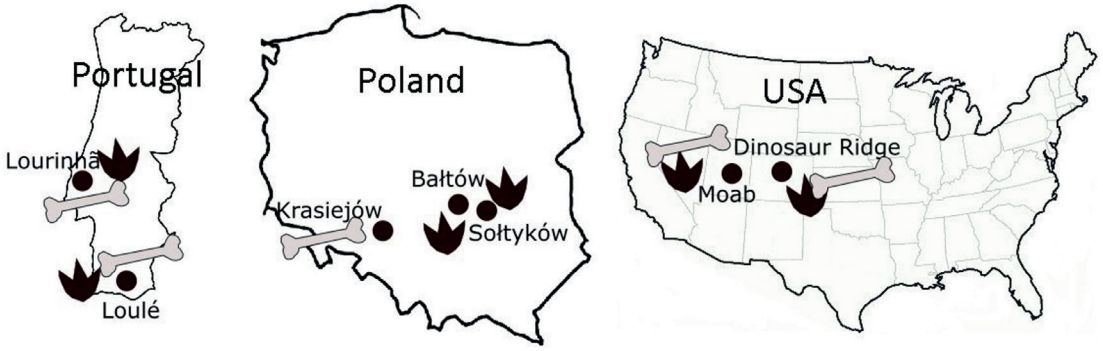

Figure 1. Selected localities with tourism based on the local dinosaur discoveries (https://commons.wikimedia.org)

3. Selected localities

Some sites feature dinosaur trackways (fossil footprints assemblages) (Sołtyków, Bałtów, Moab), while others are places of fossil bone discoveries (Krasiejów, Lourinha, Algarve) or include both (Dinosaur Ridge). However, not all the discoveries involve dinosaurs in a scientific sense. Dinosaurs are groups of archosaurs with a set of derived features that distinguish them from other sauropsids, including e.g. elongate deltopectoralhumerus crest or extensively perforated acetabulum (Fatkovsky and Weishampel, 2009). In terms of phylogeny, they are defined as a group consisting of the most recent common ancestor (MRCA) of *Triceratops* and modern birds (Neornithes), and all its descendants (Weishampel et al., 2004). However, in general public awareness, all Mesozoic tetrapods or even all prehistoric sauropsids are usually mistakenly considered as 'dinosaurs' and presented in 'dino parks' (http://www.eartharchives.org/articles/your-favorite-extinct-reptile-may-not-be-a-dinosaur/).

Lourinhã (Western Portugal)

Lourinhã is a city (and municipality) in the District of Lisbon in the Oeste subregion of Portugal with a population slightly exceeding 9 thousand citizens (https://censos.ine.pt). Geologically Lourinhã is Upper Jurassic Formation exposing in several localities in the Lusitanian Basin (central-west Portugal) (Mateus and Milàn, 2010) in close proximity to the Lourinhã city. Within the Formation, consisting of mostly alluvial sediments, deposited during the early rifting of the Atlantic Ocean (Mateus and Milan, 2010) skeletal elements of e.g. ornithopods (Rotatori et al., 2020) or stegosaurian dinosaurs with unusually long necks (*Miragaialongicollum*) were found (Mateus et al., 2009), as well as a new allosaurioid *Lourinhasaurus* (Mateus, 1998), numerous trackways of both saurischian and ornithischian dinosaurs (Antunes and Mateus, 2003) and fossilized eggs (Ribeiro et al., 2013).

Leaning on the numerous dinosaur discoveries in the area (being an important contribution to the palaeobiology field), the 'Fantastic World of Lourinhã Dinosaurs (Dino Parque)' was built, becoming the largest outdoor museum in Portugal and a famous tourist attraction of the entire Lisbon area. Apart from the palaeobiological museum, the site possess extensive additional infrastructure, including Live Lab (where visitors can see how palaeontologists work on fossil material), tracks with over 180 life-size dinosaur reconstructions, gastronomy facilities, and shops (https://portugalinews.eu/dino-parque-promotes-resto-

ration-and-removes-visitors-from-the-museum-of-lourinha/).

Loulé/Algarve (Southern Portugal)
Algarve is the southernmost region of Portugal with the administrative centre in the city of Faro, which has over 100 000 citizens. In the region Triassic, Jurassic, and Cretaceous sediments are exposed at several sites. Not all of them are easily accessible, but others like in Salema are described in tourist-guides (https://wetravelportugal.com/dinosaur-footprints-algarve/) and have tourist tracks built for easier observations. Footprints of Jurassic dinosaurs can be seen in the western part of the Algarve (at the coast). They were left by sauropods and ornithopods (Antunes and Mateus, 2003). In the Triassic sediments (Penina bone-bed, near the city of Loulé), in the centre of the Algarve region, fossil bones of reptiles and amphibians were found (Brusatte et al., 2015b; Campos et al., 2017).

These sites can be visited by individual tourists and groups thanks to „Geology in the summer" national camping event, which takes place during summer (dos Santos et al., 2008). At Salema, some fossils are accessible from the beach at low tide, but most of them can be seen from the cliff via a set of stairs built for this very purpose, however, the site lacks in well-developed tourist infrastructure, such as museums and dinosaur theme parks.

Moab (Grand County, Utah, USA)
Moab is a city in the south-eastern part of the State of Utah in the United States of America. It is the largest city in the region, however, with only about 5 000 citizens it may not be considered particularly large by general standards(https://www.census.gov/). Fossil bones and abundant dinosaur tracks were found in the region. Trackways occur in the area exceeding 300 square kilometres, and thus they are referred to as megatrack sites (Lockley, 1991). Tracks were left by the dinosaurs most popular among average tourists – theropods, like *Allosaurus*.

In the proximity of the Moab city a large dinosaur theme park was opened in 2017, which features not only numerous life-size dinosaur models (and others – like pterosaurs), but also a 5D 'aquarium cinema', playgrounds, and 'dig-sites' for the youngest dinosaur enthusiasts (https://poland.pl/economy/investments-projects/poles-open-dinosaur-park-us/).

Dakota Hogback (near Morrison, Jefferson County, Colorado, USA)
Dinosaur Ridge is a part of the formation called Dakota Hogback, situated in Jefferson County in the State of Colorado. Dakota Hogback lies in the proximity of the Town Morrison and Denver. Morrison is a small town with only a few hundred citizens (https://www.census.gov/). The site is famous in the palaeontological world for numerous well-preserved tracks of dinosaurs (like dromeosaurids) and crocodilians of the Jurassic period (Lockley, 2003; Lockley et al., 2016). At the site bones of *Stegosaurus, Apatosaurus*, and *Allosaurus* were also discovered (Lockley et al., 2001).

Albeit educational activity related to the site and discoveries is well-developed (school camps, bus trips), there is no additional infrastructure aside from trails (stairs and info-tables).

Krasiejów (Opole Silesia, Poland)
Krasiejów is a village near the city of Opole in south-west Poland. In the closed quarry, Late Triassic fine-grained deposits are exposed. Therich bone-bed of Krasiejów, which probably formed after a flash-flood (Bodzioch and Kowal-Linka, 2012), has revealed large vertebrates, such as rauisichids, temnospondyls, phytosaurs (Dzik and Sulej, 2007); and some smaller remains (Dzik and Sulej, 2016; Kowalski et al., 2019) described in numerous scientific and popular palaeontological publications. However, the discoveries did not include dinosaurs *sensustricto* (except a single microscopic tooth – Kowalski et al. 2019), only their close relative *Silesaurus* (Dzik, 2003; Mazurek and Słowiak, 2009).

Several years after the discovery, a dinosaur theme park Jura Park was established in the vicinity of the excavation site (Kostuś, 2012). The park presents dinosaur models and the excavation site with in-situ fossils. Duringthe excavation season visitors can also see palaeontologists at work. Apart from the palaeontological attractions, the visitors have access to numerous restaurants, playgrounds and cinemas (Niedźwiecki, 2012; Antczak, 2015).

Bałtów (Holy Cross Mountains, Poland)
Bałtów is a small village (around 500 citizens) near Ostrowiec Świętokrzyski in the Świętokrzyskie voivodeship in Poland. Jurassic rocks exposed in this locality form monoclinic hills extending from northwest to southeast (Pietrzak, 2005). Commonly found yellow limestones in the area in question hold remains of Mesozoic reefs, including fossils of echinoderms, crinoids, corals, gastropodsand alga (pers. observ.). In several places the above-mentioned invertebrate shells are accompanied by ichnofossils of reptiles, which were discovered many years ago and, according to local legends, had been left by the devil. In the 21stcentury, fossil footprints were described as belonging to dinosaurs – allosaurids and stegosaurids (Gierliński and Sabath, 2002; Gierliński and Niedźwiecki, 2005).

In 2004 Jura Park was established, featuring fossil footprints, life-size dinosaur models and additional tourist infrastructure, including gastronomic points. During winter there is a ski station available with six routes with the combined length of 4 km (Zieliński and Janeczko, 2016). Bałtów dinosaur theme park was the first large-scale dinosaur park in Poland, and operates under the scientific patronage of the Polish Geological Institute (Pieńkowski, 2009a).

Sołtyków (Holy Cross Mountains, Poland)
Sołtyków is a small village in the Świętokrzyskie Mountains, not far (~50km) from Bałtów, where well-preserved fossil footprints can be observed *in situ*. The most impressive ones have been secured with a wooden shelter and include tracks of several sauropods walking together and a pair of theropods headed from a different direction (Gierliński and Pieńkowski, 1999; Gierliński et al., 2004).

Unlike in Bałtów, the fossil dinosaur footprints route in Sołtyków has no additional tourist infrastructure except for the above-mentioned shelter and boards. The track sites are protected by law and remain in the area of Nature Reserve Gagaty Sołtykowskie. Aside from dinosaur trackways, "Gagaty Sołtykowskie" Nature Reserve possesses other geological attractions, including jets (polish *gagat*) – a dark type of brown coal – as well as invertebrate fossils and ichnofossils (Pieńkowski, 2009b).

4. Results

The *Trip Hobo* website indicates that "Lourinhã may not be as popular as other cities in Portugal (…), but it is a beautiful upcoming tourist destination that is worth a visit." However, search results in Portugal and English Wikipedia do not confirm this statement. According to the number of searches throughout the last 12 months (May 2019–April 2020), Lourinhã is more popular than some other municipalities with a similar number of citizens (Fig. 2). It is considered as popular as Felgueiras – a municipality two times larger (in terms of the number of citizens) – which offers particularly popular tourist attractions, such as discovered in 1992 remains of a Roman Villa from the 4th century (Pinto, 2008). One may note a distinct increase in search results in August (over a hundred more than in other months). The same pattern can be observed in relation to Krasiejów and Bałtów in Polish Wikipedia (Niedźwiecki, 2012; Antczak, 2015; 2016). Both demonstrate a higher number of searches than the adjacent, often larger villages and towns that would otherwise be considered more attractive to tourists (if palaeontological attractions were to be excluded). The number of searches for Moab (Utah) is difficult to interpret, as the Wikipedia article describes the entire region, including other world-famous geological attractions (e.g. petroglyphs and the Arches National Park). In Lourinha, Moab, Bałtów, and Krasiejów Wikipedia search rise in summer (Niedźwiecki, 2012; Antczak, 2015; 2016). This trend is not visible with regard to paleontological sites lacking extensive infrastructure (Sołtyków, Dinosaur Ridge). There are many geoparks in the Świętokrzyskie Mountains region (Strzyż, 2009; Strzyż and Wójtowicz, 2011), however the official number of tourists visiting several localities in this region confirms these observations for Bałtów (https://echodnia.eu/swietokrzyskie/top-20-najwiekszych-swietokrzyskich-atrakcji-turystycznych-w-2013-roku-zobacz/ar/c3-8028834).

The results of a survey performed in relation to Krasiejów appear to emphasize its value. The village with its palaeontological attractions proved to be the most recognizable tourist destination in the region (Antczak, 2015).

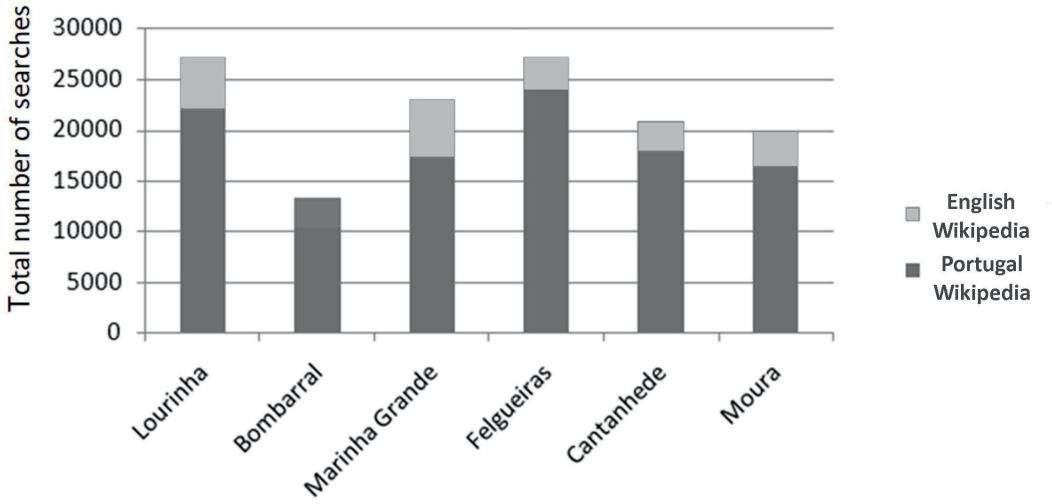

Figure 2. The number of searches pertaining to selected Portugal localities on Wikipedia between May 2019 and April 2020 (Author's own study)

Such a correlation between recognizability of a tourist destination featuring Paleontological discoveries and available attractions (theme parks) is also apparent in Google search results.

Google Trends search feature shows that 'Dino Parque' is the most frequently searched phrase and arguably the most famous tourist attraction of the Lourinhã region. The same result was obtained for Krasiejów dinosaur parks ('Jura Park') and Dinosaur Ridge in Colorado. The exception here is Moab with a new dino park ('Moab Giants'), which is more famous for its geological heritage (Arches and Canyonlands) than paleobiological findings (Antczak, 2015, 2016; Fig. 3).

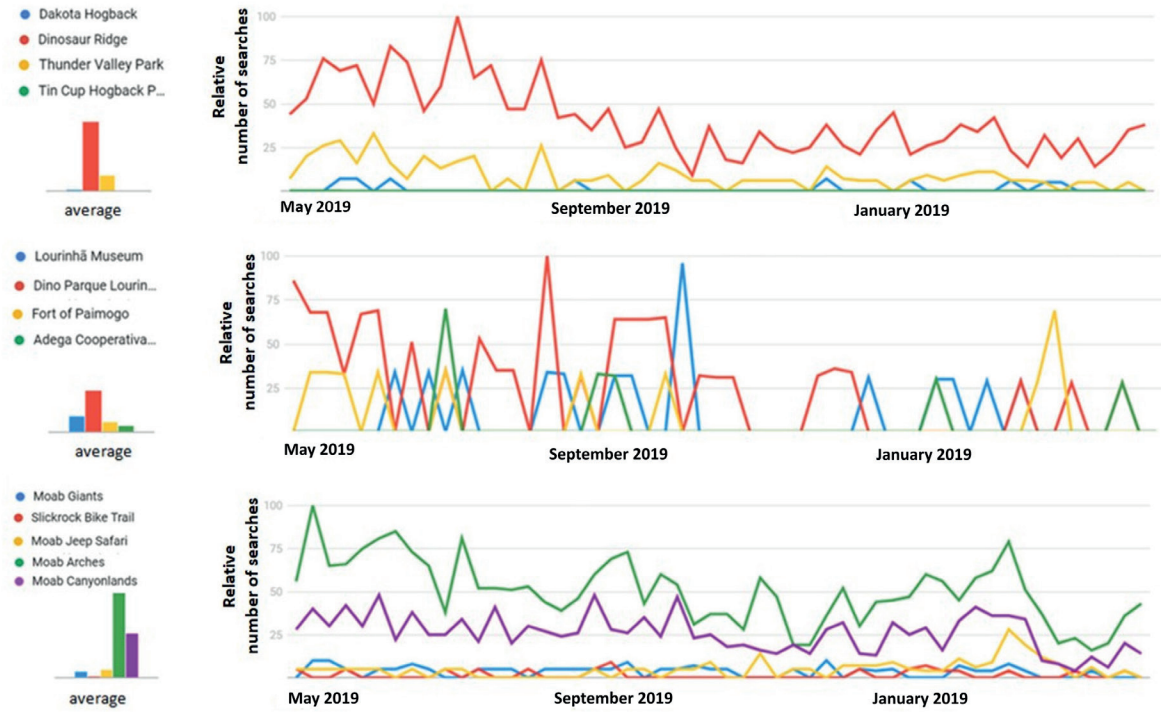

Figure 3. The number of searches in Google of selected tourist attractions (Authors own study)

5. Discussion

Presented data reveal a clear correlation between the availability of a dinosaur discovery site and the tourist attention, as the number of searches pertaining to paleontological sites (at least for those with additional infrastructure) outweigh the number of searches for other tourist destinations in the region, and highly increase in summer. Connected with well-developed tourist infrastructure local fossil heritage may be the most important attraction of the region (i.e. Lourinhã, Bałtów, Krasiejów, Morrison), depending of course on the regional tourist traffic before the discoveries and the presence of competing attractions (i.e. Moab). The rise of searches during the vacations in recent years proves the link between the number of Wikipedia and Google search and vacation tourist traffic.

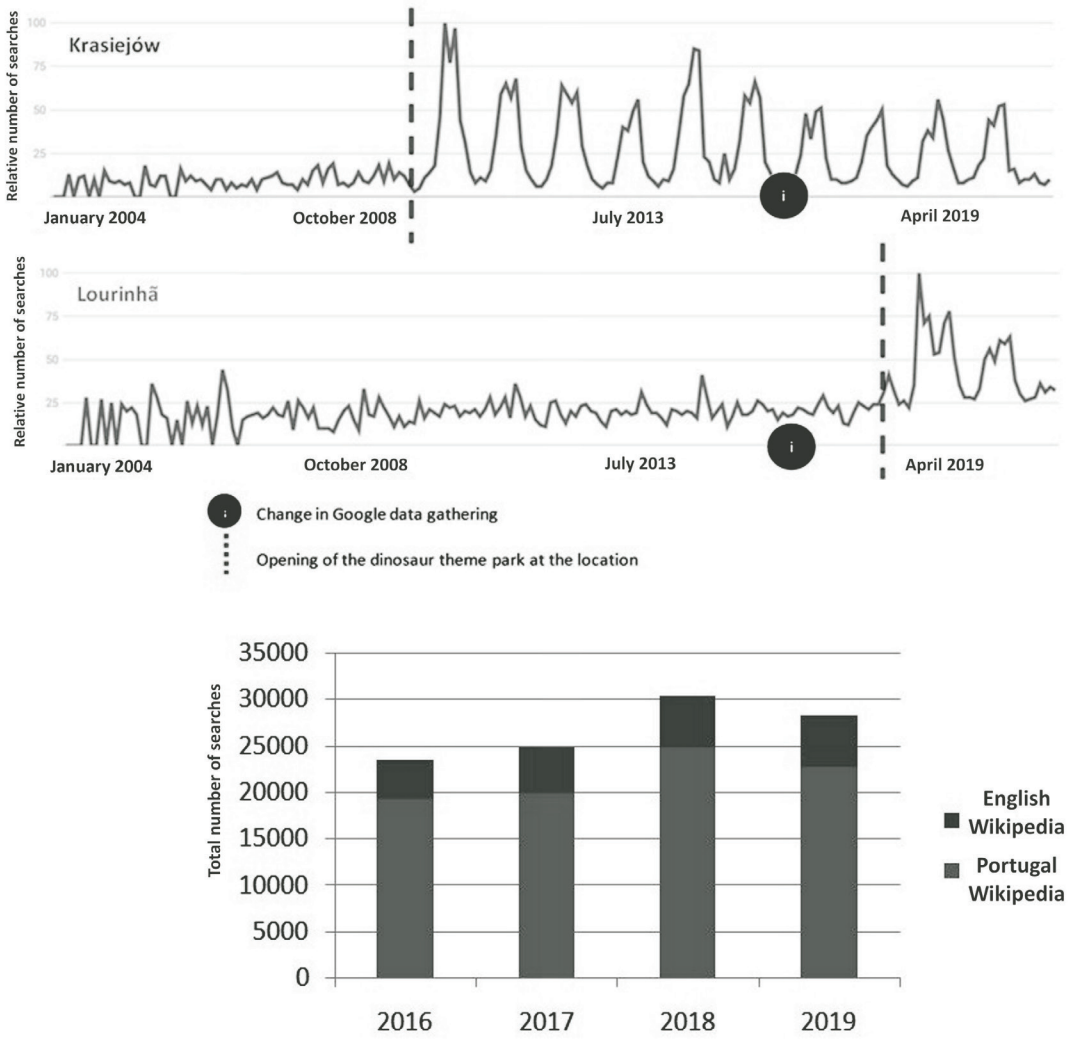

Figure 4. Rise in the search number in Google after the opening of the dinosaur theme park (top charts) and rise in the Wikipedia search number for Lourinhã after the opening of the dinosaur theme park (bottom chart) (Author's own study)

Wikipedia searches and Google Trends show that the rise in the search number is correlated with the beginning of the theme park activity – as shown here for Krasiejów and Lourinhã (Fig. 4). Dinosaur Ridge as not having special infrastructure was not included as well as Bałtów, where Jura Park was raised in 2004 and Google search archives, does not reach further into the past – also before 2000 Internet as the tourist recognition tool was not as developed as nowadays thus the results would have been biased. However, Zieliński and Janeczko (2016), while describing different tourist attractions in the Holy Cross Mountains noted that Bałtów from the little-known village became the largest

attraction of the region). The other aspect of a combination of research work and business activity at the same place is the cooperation of scientists and entrepreneurs resulting in making scientifically correct park offer like in mentioned dinosaur theme parks in Lourinhã, Krasiejów, and Bałtów (Fig. 5).

With the rise in the number of tourist visiting a given destination, adjacent places such as restaurants also noted an increase in the number of customers – Zambuejira and Casal Foz restaurants recorded a 20% increase and pointed that 40% of their customers are on their way to (or from) the park (https://portugalinews.eu/dino-parque-promotes-restoration-and-removes-visitors-from-the-museum-of-lourinha/). Similarly, adjacent hotels and agrotourism farms can also record an increase, as demonstrated by housing establishments in the proximity of Krasiejów 'Jura Park' (Antczak, 2015). On the other hand, places like the Lourinhã museum noted a distinct decrease in the number of visitors (https://portugalinews.eu/dino-parque-promotes-restoration-and-removes-visitors-from-the-museum-of-lourinha/). In addition to these observations, an important question arises whether the increase in tourist traffic is connected with scientific, palaeobiological discoveries, or perhaps constitutes a result of the establishment and operation of children amusements parks with life-size models of dinosaurs.

Comparison of search results of paleontological sites with dino parks versus sites without well-developed tourist infrastructure (even if there are educational programs and trips organized, like in Algarve – dos Santos et al. 2008 – or at Dinosaur Ridge – Wright, 2004) confirms lower interest in this kind of destinations (Fig. 6).

Figure 5. Dilophosaurus reconstruction in Jura Park in Krasiejów and Dino Expo 2019 fair in Poznań (photographed by M. Antczak and K. Gruntmejer)

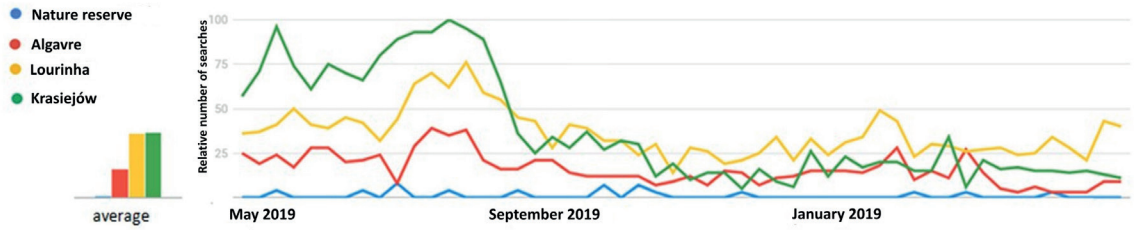

Figure 6. Comparison of Google search results for places of palaeontological discoveries (Authors own study)

Does it mean that real discoveries are not important in dinosaur tourism development? Statistics pertaining to the number of tourists having visited/specific attractions in Poland appear to refute this. Bałtów and Krasiejów 'Jura Parks' (the only parks based on the local palaeontological findings) are the two most often visited dinosaur them parks among over 20 in the country (https://wetravelportugal.com/dinosaur-footprints-algarve/), and only one

large park did not share their data for the statistics – Kruczek, 2014). However, when comparing villages and small towns with locations featuring a larger number of tourist attraction, one should note that the amusements parks usually constitute a destination for only one-day trip (as they are often the sole attraction ofa given-location – for examplein Krasiejów or Bałtów) (Antczak, 2015; 2016).

The short survey about dinoparks and their elements reveals that the local scientific discoveries are an important factor when choosing the destination, however, they are often not attractive enough if not combined with amusement infrastructure, especially when traveling with children.

Most of the interviewed adult tourists prefer to visit dinosaur park with fossils found at the site (60.7%, Fig. 7) presented along with dinosaur models, and almost half of the respondents (56) opt to visit a palaeontological site as such, rather than a dinosaur park (48.2%). Nevertheless, these survey participants admitted that if they were to be accompanied by children, their answer might be different. They also point to local findings as the most important element of the dinosaur park. For children fossils *in situ* are not as attractive. They typically focus on life-size dinosaur models and possibly museum exhibitions of mounted skeletons (Fig. 7, commentaries obtained for the survey).

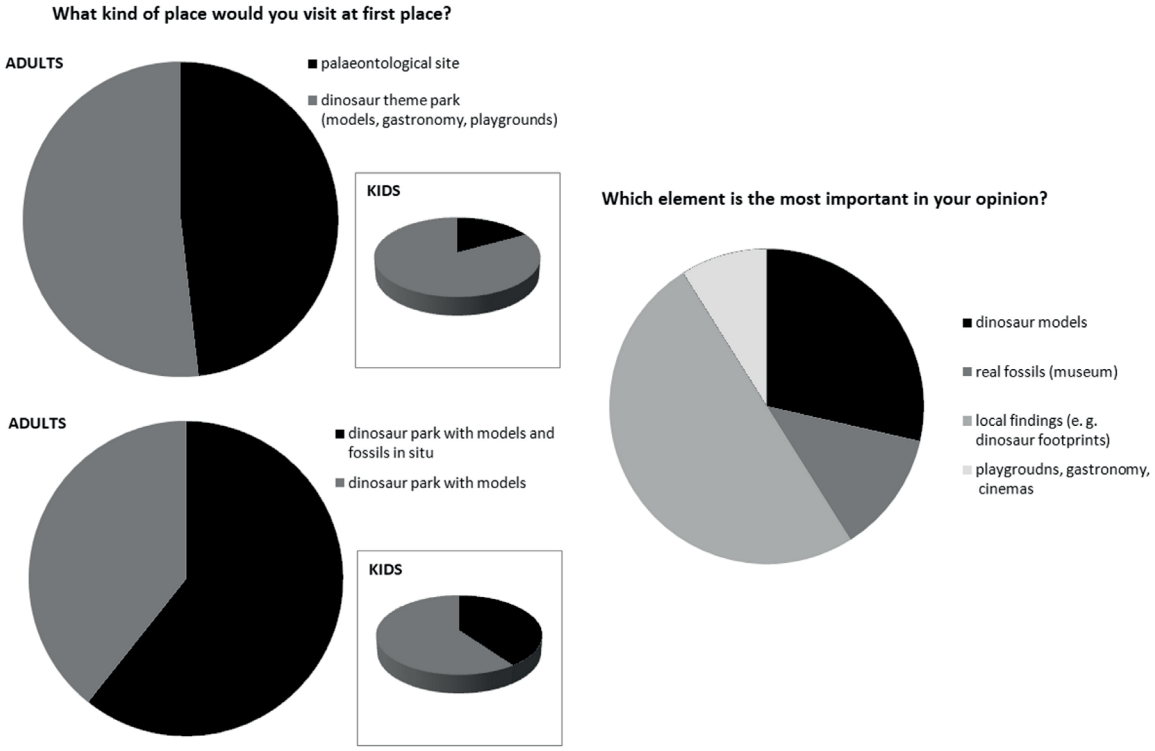

Figure 7. Results of the survey on palaeontological (dinosaur) tourism (Author's own study)

Well-organized tourism based on palaeontological discoveries can also contribute to local gastronomy, increase in agrotourism and hotel visitors, as well as environmental restoration, which is important to a large number of visitors and the local community (Wójtowicz et al., 2011; Antczak, 2015; 2016), and helps small town become better-known (Zieliński and Janeczko, 2016; Cobos et al., 2020).

Using paleontological discoveries to boost local tourism is still prospective, e.g. 'Moab Giants' and 'Lourinhã Dino Parque' were opened in the last three years and are now visited by hundreds of thousands of tourists. Multiplication of such destinations would also help protect a greater number of sites and prevent over-exploitation of the ones currently available to tourists (dos Santos et al., 2008).

6. Conclusions

The Internet search result in Wikipedia and Google, as well as some literature/statistical data clearly show that local tourism might be built on scientific, paleontological discoveries, specifically connected with dinosaurs and other Mesozoic tetrapods. However, to become very popular – e.g. over 400 000 visitors a year in Bałtów 'Jura Park' (in a country with a population of approx. 38 million) (https://radioostrowiec.pl/2019/01/30/baltow-odwiedzilo-ponad-400-tys-turystow/; Cierniak-Piotrowska and Znajewska, 2019) or 500 000 visitors a year in Lourinhã 'Dino Parque' (in a country with a population of around 10 million) https://portugalinews.eu/dino-parque-da-lourinha-reaches-500-000-visitors/; https://censos.ine.pt), the scientific values have to be supported with amusement attractions, i.e. dinosaur theme parks with life-sized models of dinosaurs, gastronomic infrastructure, playgrounds, cinemas and others.

Nevertheless, it is worth highlighting that the benefits of such trends are mutual, because dinosaur parks with real scientific discoveries at the place are more popular than those without a local paleontological base.

Thus, for places of great scientific value protection to be more effective (and profitable), they should be combined with educational programs and amusement infrastructure elements. Palaeontological discoveries and results of palaeobiological analysis reproduced in popular media automatically become an advertisement for amusement parks established at the place of scientific findings, and as parks advertise in various media (as every business activity typically does), they spread knowledge about local discoveries and dinosaur research. Furthermore, cooperation between scientists and entrepreneurs leads to the creation of more scientifically correct dinosaur models, as well as helps address and rectify many well-established misconceptions about these creatures. Paleontological tourism can contribute to local community by developing gastronomy, hotels and nature restoration.

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References

Alvarez L.W., Alvarez W., Asaro F., Michel, H.V., 1980. Extraterrestrial cause for the Cretaceous-Tertiary Extinction. Science 208, 1095-1108.

Antczak M., 2015. Scientific discovery and local tourism development on the example of Krasiejów. Studenckie Prace Herpetologiczne 3, 33-41 [In Polish with English abstract].

Antczak M., 2016. Tropy dinozaurów a rozwój turystyki lokalnej w Bałtowie. [In:] Panfil M. [Ed.], Badania i Rozwój Młodych Naukowców w Polsce-Nauki Przyrodnicze III. Wydawnictwo Młodzi Naukowcy, Poznań, 20-25 [In Polish].

Antunes M.T., Mateus O., 2003. Dinosaurs of Portugal. Comptes Rendus Palevol 2, 77-95 [In Portugal].

Avila S.P., Cachaos M., Ramalho R.S., Botelho A.Z., Madeira P., Rebelo A.C., Cordeiro R., Melo C., Hipólito A., Ventura M.A., Lipps J.H., 2016. The paleontological heritage of Santa Maria Island (Azores: NE Atlantic): a re-evaluation of geosites in GeoPark Azores and their use in geotourism. Geoheriatge 8, 155-171.

Bodzioch A., Kowal-Linka M., 2012. Unraveling the origin of the Late Triassic multi taxic bone accumulation at Krasiejów (S Poland) by diagenetic analysis. Palaeogeography Palaeoclimatology Palaeoecology 346-347, 25-36.

Bodzioch A., Wężowicz-Ziółkowska D., 2016. Resurrection of the Wawel Dragon. A voice on the memetic evolution and the defense of inviolability of proper names. Teksty z Ulicy, Zeszyt Memetyczny 17, 147-166 [In Polish with English abstract].

Brusatte S.L., Butler R.J., Barrett P.M., Carrano M.T., Evans D.C., Lloyd G.T., Mannion P.D., Norell M.A., Peppe D.J., Upchurch P., Williamson, T.E., 2015a. The extinction of dinosaurs. Biological Review 90, 628-642.

Brusatte S.L., Butler R.J., Mateus O., Steyer, J.S., 2015b. A new species of *Metoposaurus* from the Late Triassic of Portugal and comments on the systematics and biogeography of metoposaurid Temnospondyls. Journal of Vertebrate Paleontology e91288, DOI: https://doi.org/10.1080/02724634.2014.912988.

Campos H., Mateus O., Moreno-Azanza M., 2017. Preliminary results on the stratigraphy and taphonomy of multiple bone beds in the Triassic of Algarve. [In:] Barrios de Pedro S., Blanco Moreno C., de Celis A., Colmenar J., Cuesta E., García-Martínez D., Gascó F., Jacinto A., Malafaia E., Martín Jiménez M., de Miguel Chaves C., Mocho P., Pais V., Páramo Blázquez A., Pereira S., Serrano Martínez A., Vidal D. [Eds.], A Glimpse of the Past. Abstract book of the XV Encuentro de Jóvenes Investigadoresen Paleontología 19-22.04.2017. Fundación para el studio de los Dinosaurios en Castilla y León, Lisboa, 83-87.

Canudo J.I., 2012. Palaeontology research and its application as cultural tourism in Aragon (Spain). Virtual Archaeology Review 3, 28-32.

Carvalho I.S., Da-Rosa A.A.S., 2008. Paleontological tourism in Brasil: examples and discussion. Arquivos do Museu Nacional 66, 271-283.

Cierniak-Piotrowska M., Znajewska A. (Eds.), 2019. Population. Size and structure and vital statistics in Poland by territorial division in 2019. As of 30th June. Statistics Poland, Warszawa, 1-19.

Cobos A., Alcala L., Royo-Torres R., 2020. The dinosaur route in El Castellar (Teruel, Spain): Palaeontology as a factor of territorial development and scientific education in a sparsely inhabited area. Geoheritage 12(52), DOI: https://doi.org/10.1007/s12371-020-00474-3.

Da-Rosa A.A.S., 2008. Paleontological tourism in Santa Maria, southern Brazil: potential vs. reality. Arquivos do Museu Nacional 66, 291-304.

Dos Santos V.F., da Silva C.M., Rodrigues L.A., 2008. Dinosaur track sites from Portugal: Scientific and cultural significance. Oryctos 8, 77-88.

Dzik J., 2003. A beaked herbivorous archosaur with dinosaur affinities from the early Late Triassic of Poland. Journal of Vertebrate Palaeontology 23, 556-574.

Dzik J., Sulej T., 2007. A review of the Elary Late Triassic Krasiejów biota from Silesia, Poland. Palaeontologia Polonica 64, 3-27.

Dzik J., Sulej T., 2016. An Early Late Triassic long-necked reptile with a bony pectoral shield and gracile appendages. Acta Palaeontologica Polonica 61, 805-823.

Fatkovsky D.E., Weishampel D.B., 2009. Dinosaurs: A concise natural history. Cambridge University Press, Cambridge, Berkeley.

Gaworecki W. 2003. Turystyka. Polskie Wydawnictwo Ekonomiczne, Warszawa [In Polish].

Gierliński G., Pieńkowski G., 1999. Dinosaur track assemblages from the Hettangian of Poland. Geological Quarterly 43, 329-346.

Gierliński G., Sabath K., 2002. A probable stegosaurian track from the Late Jurassic of Poland. Acta Palaeontologica Polonica 47, 561-564.

Gierliński G., Niedźwiedzki G., Pieńkowski G., 2004. Tetrapod track assemblage in the Hettangian of Sołtyków, Poland, and its paleo environmental background. Ichnos 11, 195-213.

Gierliński G., Niedźwiedzki G., 2005. New saurischian dinosaur footprints from the Lower Jurassic of Poland. Geological Quarterly 49, 99-104.

Górnicki S., 2016. Education and Outreach: Dinosaurs in the movies. Palaeontology Online 6, Article 9, 1-7.

Górnicki S., 2017. Education and Outreach: The history of dinosaur palaeoart. Palaeontology Online 7, Article 9, 1-9.

Hose T.A., 2000. European 'geotourism' - geological interpretation and geoconservation promotion for tourists. [In:] Barretino D., Wimbledon W.P., Gallego E. (Eds.), Geological Heritage: Its Conservation and Management. Instituto Tecnologico Geominero de Espana, Madrid, 127-146.

Kostuś T., 2012. Society „Dinopark" 2003-2012. [In:] Jagt-Yazykova E., Jagt J.W.M., Bodzioch A., Konietzko-Mejer D. (Eds.), Krasiejów – paleontologicalinspirations. ZPW „Plik", Bytom, 3-5 [In Polish with English summary].

Kowalski J., Bodzioch A., Janecki P.A., Ruciński M.R., Antczak M., 2019. Preiliminary report on the microvertebrate faunal remains from the Late Triassic locality at the Krasiejów, SW Poland. Annales Societatis Geologorum Poloniae 89, 291-305.

Kruczek Z.,2012. Current trends in the development of tourist attractions. [In:] Conference Proceedings, Aktualny trendy Lazenstva, Hotelnictvia a Turismu, April 2012, Slezskáuniverzita v Opavě, 1-8.

Kruczek Z., 2014. Attendance in Polish tourist attractions. Problems of evaluation number of visitors. Polska Organizacja Turystyczna, Kraków-Warszawa [In Polish with English abstract].

Lockley M.G., 1991. The Moab Megatracksite: A Preliminary Description and Discussion of Millions of Middle Jurassic Tracks in Eastern Utah. [In:] Averitt W.R. (Ed.), Guidebook for dinosaur quarries and track sites tour, western Colorado and Eastern Utah. Grand Junction Geological Society, Grand Junction, 59-65.

Lockley M.G., Hook N., Taylor A., 2001. A brief history of dinosaur research and public education on Dinosaur Ridge. The Mountain Geologist 38, 87-95.

Lockley M.G., 2003. Fossil Footprints of the Dinosaur Ridge and Fossil Trace Areas. University of Colorado at Denver Dinosaur Trackers Research Group. Friends of Dinosaur Ridge, Denver, USA.

Lockley M.G., Xing L., Matthews A.M., Breihaupt B.H., 2016. Didactyl raptor tracks from the Cretaceous, Plan view Sandstone at Dinosaur Ridge. Cretaceous Research 61, 161-168.

Mateus O., 1998. *Lourinhanosaurusantunesi*, a new Upper-Jurassic allosauroid (Dinosauria: Theropoda) from Lourinhã (Portugal). Memoira's da Academia das Ciencias de Lisboa 37, 111-124.

Mateus O., Maidment S.C.R., Christiansen N.A., 2009. A new long-necked 'sauropod-mimic' stegosaur and the evolution of the plater dinosaurs. Proceedings of the Royal Society B: Biological Sciences 276, 1815-1821.

Mateus O., Milàn, J., 2010. A diverse Upper Jurassic dinosaur ichnofauna from central-west Portugal. Lethaia 43, 245-257.

Mazurek D., Słowiak J., 2009. Silezaur dinozaurem? Przegląd Geologiczny 57, 569-571 [In Polish].

Newsome D., Hughes, M., 2016. Jurassic World as a contemporary wildlife tourism theme park allegory. Current Issues in Tourism 20(13), 1311-1319.

Niedźwiecki R., 2012. From iron to *Silesaurus*. The discovery of a Triassic tetrapod grave yard and the history of mining at Krasiejów. [In:] Jagt-Yazykova E., Jagt J.W.M., Bodzioch A., Konieczko-Mejer D. (Eds.), Krasiejów – paleontological inspirations. ZPW „Plik", Bytom, 6-27 [In Polish with English summary].

Nikolić E.V., 2019. Creation of the Mammoth Park at Viminacium, Serbia. Geoheritage 11, 935-947.

Pietrzak W., 2005. Atrakcje geoturystyczne okolic Bałtowa. PhD degree, unpublished work, Akademia Górniczo-Hutnicza, Kraków [In Polish].

Pinto M.M., 2008. Villa Romana de Sendim. Roteiro e Exposição Permanente, Felgueiras [In Portugal].

Pieńkowski G. 2009a. Krzemionki opatowskie i Bałtów – wycieczka w jurajską przeszłość. [In:] Trela W., Złonkiewicz Z. (Eds.), Perspektywy rozwoju geoparków w regionie świętokrzyskim. Kieleckie Towarzystwo Naukowe, Kielce, 47-54 [In Polish with English abstract].

Pieńkowski G. 2009b. Sołtykow i Niekłań – zapis sedymentacyjny i paleoekologiczny wczesnojurajskich utworów kontynentalnych oraz marginalno-morskich. [In:] Trela W., Złonkiewicz Z. (Eds.), Perspektywy rozwoju geoparków w regionie świętokrzyskim. Kieleckie Towarzystwo Naukowe, Kielce, 31-46 [In Polish with English abstract].

Ribeiro V., Mateus O., Holwerda F., Araujo R., Castanhinha R., 2013. Two new teropod eggs sites from the Late Jurassic Lourinhã Formation Portugal. Historical Biology 26(2), 206-217.

Rotatori F.M., Moreno-Azanza M., Octávio M., 2020. New information on ornithopod dinosaurs from the Late Jurassic of Portugal. Acta Palaeontologica Polonica 65(1), 35-57.

Schoene B., Samperton K.M., Eddy M.P., Keller G., Adatte T., Bowring S.A., Khadri S.F.R., Gertsch B., 2015. U-Pb geochronology of the Deccan Traps and relation to the end-Cretaceous mass extinction. Science 347(6218), 182-184.

Schwanke C., Silva M.A. J., 2004. Educação e Paleontologia. [In:] Carvalho, I.S. (Ed.), Paleontologia: cenários da vida. Interciência 2, Rio de Janeiro, 123-130 [In Portugal with English abstract].

Strzyż M., 2009. Wybrane aspekty rozwoju geoparków region świętokrzyskiego. [In:] Trela W., Złonkiewicz Z. (Eds.), Perspektywy rozwoju geoparków w regionie świętokrzyskim. Kieleckie Towarzystwo Naukowe, Kielce, 9-26 [In Polish with English abstract].

Strzyż M., Wójtowicz B., 2011. The concept of the Świętokrzyski Geopark – selected aspects. Problemy Ekologii Krajobrazu 29, 117-122 [In Polish with English abstract].

Tomić N., Marković S.B., Korać M., Mrdić N., Hose T.A., Vasijević D.A., Jovičić M., Gavrilov. B., 2015. Exposing mammoths: from loess research discovery to public palaeontological park. Quarternary International 372, 142-150.

Weishampel D.B., Dodson P., Osmólska H., Hilton R.P., 2004. The Dinosauria. Berkeley: University of California Press, Berkeley.

Woźniak P., Sikora R., Lasoń K., Markowiak M., Haisig J., Szulc J., Hagdorn H., 2010. Geopark Góra Św. Anny – udokumentowanie i propozycja jego ochrony. Państwowy Instytut Geologiczny - Państwowy Instytut Badawczy, Oddział Dolnośląski, Sosnowiec, 1-116 [In Polish].

Wójtowicz B., Strachowska R., Strzyż M., 2011. The perspectives of the development of tourism in the areas of geoparks in Poland. Procedia - Social and Behavioral Sciences 19, 150-157.

Wright J.J., 2004. Walking with dinosaurs (and other extinct Animals) along Colorado's Front Range: A field trip to Palaeozoic and Mesozoic terrestrial localities. [In:] Nelson E.P., Erslev E.A. (Eds.), Field trips in the Souther Rocky Mountains. Geological Society of America Field Guide 5, USA, 219-232.

Zieliński A., Janeczko K., 2016. Greatest tourist attractions in Świętokrzyskie voivodeship by the tourist opinions. Scientific Bulletin of the Szczecin University: Economic Problems of Tourism 2(34), 297-307 [In Polish with English summary].

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https://echodnia.eu/swietokrzyskie/top-20-najwiekszych-swietokrzyskich-atrakcji-turystycznych-w-2013-roku-zobacz/ar/c3-8028834 (Date of access: 13.05.2020).

https://radioostrowiec.pl/2019/01/30/baltow-odwiedzilo-ponad-400-tys-turystow/ (Date of Access: 9.05.2020).

https://portugalinews.eu/dino-parque-promotes-restoration-and-removes-visitors-from-the-museum-of-lourinha/ (Date of access: 14.05.2020).

http://www.eartharchives.org/articles/your-favorite-extinct-reptile-may-not-be-a-dinosaur/ (Date of access: 8.05.2020).

https://censos.ine.pt/ (Date of access: 10.05.2020).

https://portugalinews.eu/dino-parque-da-lourinha-reaches-500-000-visitors/ (Date of access: 14.05.2020).

https://poland.pl/economy/investments-projects/poles-open-dinosaur-park-us/ (Date of access: 12.05.2020).

https://www.census.gov/ (Date of access: 13.05.2020).

https://wetravelportugal.com/dinosaur-footprints-algarve/ (Date of access: 7.05.2020).