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Geotourism — A geographical review of the literature

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ABSTRACT

Geological tourism (geotourism) is a global activity that represents an important research direction. The latter is very "young", but has spread rapidly since the 2000s. The geographical pattern of geotourism research can be examined through a bibliographical survey. A total of 165 journal articles were selected on geotourism published by 417 specialists from 45 countries during the 2012–2014 term. Authors' affiliations and the focus of regional research were analyzed. The results demonstrate that geotourism research concentrates in Europe, East Asia, the Middle East, and South America. The largest research communities are active in Italy, Brazil, China, and Poland. Overall, geotourism studies are conducted on all continents (except for Antarctica). The results demonstrate the global scale of geotourism research. The spread of this concept also is shown by the evidence of the growth of national and international networks of specialists. There is no good explanation for the documented world distribution of geotourism research that can be fully confirmed. Such an outcome implies that the geographical pattern of this rising scientific discipline is determined by a set of puzzling factors that may be equally important.

1. Introduction

During the past two decades, geological tourism (geotourism) has become an important activity on the local, national, and international levels (Dowling, 2011; Dowling & Newsome, 2010; Farsani et al., 2014; Gray, 2013; Lazzari & Aloia, 2014). It employs geological heritage sites (geosites), ex situ heritage objects (primarily those from museum collections), specially created geoparks, and other geology-related objects for the purposes of tourism and recreation. Its main objectives include the promotion of geological knowledge, an increase in the awareness of geological heritage and its conservation needs, and the diversification and sustainable development of the tourism industry. Geotourism has also become an important research subject. Its main ideas, tasks, methods, and challenges have been reviewed by Hose (2000), Pralong (2006), Gray (2008, 2013), Dowling and Newsome (2010), Newsome and Dowling (2010), Dowling (2011), Badiali and Piacente (2012), Gordon (2012a), Hose and Vasiljevic (2012), Ollier (2012), Martinez-Grana et al. (2013), Cayla (2014), Farsani et al. (2014), Lazzari and Aloia (2014). At least three international journals, namely "Geojournal of Tourism and Geosites", "Geoheritage", and "Proceedings of the Geologists' Association", regularly publish research articles on geotourism, and related articles also appear in many other international and local geoscience and tourism journals; books (both as conference volumes and monographs) on this subject are available.

Geotourism research began to flourish about a decade ago, and it is still in a "young" stage of development (Fig. 1). Therefore, analysis of its current progress offers a unique opportunity to understand how scientific disciplines arise in a modern, globalized world. Undoubtedly, the questions of research geography are of utmost importance, because an understanding of scientific progress requires knowledge of the distribution of new ideas among the international and national research communities. The present paper focuses on the current world distribution of geotourism research. Three main objectives are as follows. First, the geographical patterns of geotourism research need to be documented. Second, it should be understood whether geotourism research has become truly global in scale. Third, the validity of several possible explanations for the world distribution of this rising discipline should be considered and discussed.

2. Material and methods

An article published in an international journal is the main (although not the only) outcome of modern research on geotourism (e.g., Dowling, 2014a,2014b; Lund, 2012; Snieder & Larner, 2009). Therefore, journal articles on any give subject are considered to reflect current research on this subject more or less adequately. It is supposed that each specialist active in her/his own field publishes at least one article in three years. For the purposes of this study, a bibliographical survey was attempted

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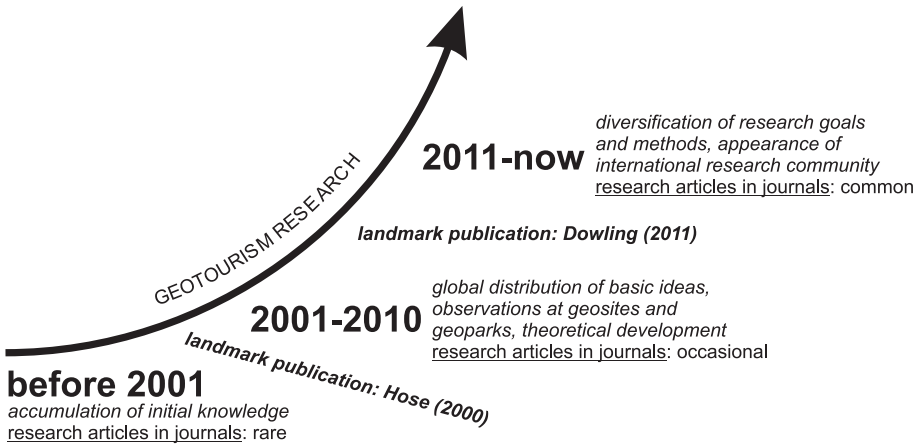

Fig. 1. The main stages of geotourism research development.

in December 2014. Journal articles on geotourism published during the 2012–2014 term were searched for using the on-line database "Scopus" (available on-line at scopus.com). A total of 165 articles with the terms "geotourism" and "geological tourism" in their title, abstract, and/or key words were selected.

The database of specialists, who authored or co-authored at least a single journal article among those selected, was composed. For each author, the country of affiliation (where her/his institution was located as indicated by the article) and the study region were specified. This paper focuses on countries because geotourism development differs depending on national traditions of geological heritage exploitation and nature conservation. The study regions were categorized as very large territories equal to continents and their large parts. It should be noted that one specialist may represent more than one country, and her/his research may be conducted in several regions. Some articles are theoretical and do not focus on any given region. Generally, the database employed for the purposes of the present study includes information on 417 specialists from 45 countries who addressed various regions ranging from Europe to Australia (Table 1).

The current world distribution of geotourism research is analyzed on the basis of two methods. First, the number of specialists who published journal articles on geotourism in 2012–2014 pro-rated among countries of affiliation is considered. This approach distinguishes countries with the presence of active geotourism research communities or individual specialists working in this field and permits the documentation of spatial tendencies in their location (or the absence of such tendencies). Second, the number of specialists who published journal articles on geotourism in 2012–2014 per study region is considered. This allows the visualization of proportions (or disproportions) in the current focus of regional research.

Undoubtedly, this kind of review has certain limitations. On the one hand, some specialists may prefer publication of results from their research in the form of books or conference abstracts, i.e., not as journal articles. Unfortunately, there is no possibility to take into account all these publications. Moreover, if geotourism research has become a distinct discipline, it should be "natural" for scientists to make efforts on publishing articles in international journals. On the other hand, the on-line bibliographical database "Scopus" does not cover all journals in the world, especially those that are local and published in languages other than English (although it includes numerous journals of these kinds). For instance, there are geotourism publications in Russian journals that are absent in "Scopus". The reasons to ignore this limitation are the same as in the previous case.

3. Results

The specialists who published journal articles on geotourism during the past three years come from many countries located in different parts of the world (Table 2, Fig. 2). Geotourism researchers are concentrated in Europe, where they are active in about two dozen countries. Much research is attempted in Asia, although it is concentrated in East Asia (first of all, in China and less in Malaysia) and the Middle East (mainly, in Iran). There are specialists in the discussed field in all three countries of North America, as well as in New Zealand. In South America, geotourism research is concentrated in Brazil. In Africa, specialists in geotourism with journal articles are rare, although they represent as many as five countries. In many countries, there exist only a very modest geotourism research communities or only a few individual specialists (Fig. 2). However, there are four countries with relatively large research communities that often include specialists from several (even numerous) institutions. These are situated in Italy, Brazil, China, and Poland (listed in descending order), where there are dozens of specialists publishing journal articles on geotourism. A relatively large number of specialists are available in the USA, Australia, the UK, Portugal, Spain, Iran, and Serbia. One should note that these countries are located in widely different parts of the world (Fig. 2).

The situation with regard to research focus is somewhat different. Some specialists who published journal articles on geotourism during the past three years dealt with the geological heritage of the entire world (Table 1, Fig. 3). Although the majority of them paid attention to Europe, Asia, and (less) South America, their articles were also devoted to Africa, Australia, North America, and two oceans (Fig. 3). Interestingly, the total number of journal articles on Africa is a bit larger than that for Australia and North America. Only Arctica and Antarctica have remained "white spots" on the global map with respect to geotourism research focus (Fig. 3). A comparison of the world distribution of geotourism research communities (Fig. 2) and their regional research focus (Fig. 3) suggests that many specialists preferred to study geotourism in their native countries, but many also were involved in truly international research programs and preferred either to study the "remote" (relative to their home location) regions alone or to collaborate with those specialists from other countries.

All the above material permits the conclusion that Europe, Asia (East Asia and the Middle East), and South America (Brazil) are "centers" of world geotourism research with regard to: 1) where the specialists are located, and 2) which regions they focus on. However, there is strong evidence for the global-scale of geotourism research as suggested by: 1) the geographical distribution of specialists and their study

Table 1
Specialists published journal articles on geotourism in 2012–2014.

Specialists	Citations	Countries of affiliation	Study regions[a]
Abad M.	Gonzalez-Delgado et al. (in press)	Chile, Spain	Europe
Abbasi S.	Mashal et al. (2012)	Iran	Middle East
Ahmad H.	Eshraghi et al. (2012)	Malaysia	Middle East
Ahmed M.H.	El-Asmar et al. (2012)	Egypt	North Africa
Allan M.	Allan (2014)	Jordan	Middle East
Aloia A.	Lazzari & Aloia (2014)	Italy	
Amato V.	Amato et al. (2012)	Italy	Europe
Anfuso G.	Rangel-Buitrago et al. (2013)	Colombia, Spain	South America
Anshuka	Davis et al. (2013)	USA	Pacific Ocean
Antouskova M.	Spacek & Antouskova (2013)	Czech Republic	Europe
Aoki K.	Davis et al. (2013)	USA	Pacific Ocean
Arabegum R.	Ehsan et al. (2013)	Malaysia	
Arauho J.L.L.	Lopes et al. (2012)	Brazil	South America
Araujo M.S.	Bento et al. (2012)	Brazil	South America
Asrat A.	Asrat & Zwolinski (2012); Asrat et al. (2012)	Ethiopia	East Africa
Assal E.M.	El-Asmar et al. (2012)	Egypt	North Africa
Aucelli P.P.C.	Aucelli et al. (2013)	Italy	Europe
Avdullahi S.	Avdullahi et al. (2013)	Serbia	Europe
Badiali F.	Badiali & Piacente (2012)	Italy	Europe
Bala A.L.M.	Henriques et al. (2013)	Angola	South Africa
Balaz B.	Strba et al. (in press)	Slovakia	
Balazic G.	Balazic et al. (2012)	Slovenia	Europe
Ballantyne R.	Xu et al. (2013)	Australia	East Asia
Baran-Zglobicka B.	Zglobicki & Baran-Zglobicka (2013)	Poland	Europe
Belcavelo R.	Nummer et al. (2012)	Brazil	South America
Bento L.C.M.	Bento et al. (2012)	Brazil	South America
Bican-Brisan N.	Bican-Brisan et al. (2013)	Romania	Europe
Bilou F.	Lopes et al. (2013)	Portugal	Europe
Black R.	Crawford & Black (2012)	UK	Europe
Boggiani P.C.	Lobo & Boggiani (2013)	Brazil	South America
Boley B.B.	Boley & Nickerson (2013)	USA	
Bollati I.	Bollati et al. (2013); Pelfini & Bollati (2014)	Italy	Europe
Borzecki R.	Siuda & Borzecki (2014)	Poland	Europe
Bosson J.-B.	Bosson & Reynard (2012)	Switzerland	Europe
Bozic S.	Tomic & Bozic (2014)	Serbia	Europe
Branco M.	Lopes et al. (2013)	Portugal	Europe
Bratton A.	Bratton et al. (2013)	UK	
Brito L.S.M.	Brito & Perinotto (2012)	Brazil	South America
Brown G.	Kim & Brown (2013)	Australia	Australia
Bruno D.E.	Bruno & Perrotta (2012); Bruno et al. (2014)	Austria, Italy	Europe
Bruschi V.M.	Bruschi et al. (2012)	Italy	Europe
Budd G.E.	Sookias et al. (2013)	Sweden	Australia, East Asia, Europe, North America, South America
Burek C.	Burek (2012)	UK	Europe
Burlando M.	Poggi et al. (2013)	Italy	Europe
Carvalho I.D.S.	dos Santos & Carvalho (2012); dos Santos & Carvalho (2013); Ribeiro et al. (in press)	Brazil	South America
Castro P.T.A.	Ostanello et al. (2012)	Brazil	South America
Cavagna S.	Zunino et al. (2012)	Italy	Europe
Cayla N.	Cayla (2014)	France	
Cesarano M.	Aucelli et al. (2013)	Italy	Europe
Chakraborty A.	Chakraborty et al. (in press)	Japan	East Asia
Chakraborty S.	Chakraborty et al. (in press)	Japan	East Asia
Chen T.	Dong et al. (2014)	China	East Asia
Cheung L.T.O.	Cheung et al. (2014)	China	East Asia
Ciarcia S.	Amato et al. (2012)	Italy	Europe
Cimarra C.A.	Martinez-Grana et al. (2013)	Spain	Europe
Civis J.	Gonzalez-Delgado et al. (in press)	Spain	Europe
Clari P.	Zunino et al. (2012)	Italy	Europe
Coelho C.O.A.	Farsani et al. (2012); Farsani et al. (2014)	Portugal	Middle East
Cook M.	Davis et al. (2013)	USA	Pacific Ocean
Cooper M.	Chakraborty et al. (in press)	Japan	East Asia
Coratza P.	Bruschi et al. (2012); Coratza et al. (2012); Reynard & Coratza (2013)	Italy	Europe
Correa I.D.	Rangel-Buitrago et al. (2013)	Colombia	South America
Costa C.M.M.	Farsani et al. (2012); Farsani et al. (2014)	Portugal	Middle East

(continued on next page)

Table 1 (*continued*)

Specialists	Citations	Countries of affiliation	Study regions[a]
Costabloz V.	Desbois & Costabloz (2013)	France	Europe
Crawford K.R.	Crawford & Black (2012)	UK	Europe
Crowley B.E.	Bruno et al. (2014)	USA	
Cucos Dinu A.	Bican-Brisan et al. (2013)	Romania	Europe
Cui Q.	Xu et al. (2013)	China	East Asia
D'amico D.	Miccadei et al. (2014)	Italy	Europe
Da Costa Erthal F.	Mansur et al. (2013)	Brazil	South America
da Silva G.	Salamuni et al. (2013)	Brazil	South America
da Silva P.A.H.	Salamuni et al. (2013)	Brazil	South America
da Silva V.P.	Bento et al. (2012)	Brazil	South America
Dabrio C.J.	Gonzalez-Delgado et al. (in press)	Spain	Europe
Danderfer A.	Ostanello et al. (2012)	Brazil	South America
Davis S.	Davis et al. (2013)	USA	Pacific Ocean
de Almeida D.P.M.	de Borba et al. (2013)	Brazil	South America
de Andrade J.M.	de Sena et al. (2012)	Brazil	South America
de Borba A.W.	de Borba et al. (2013)	Brazil	South America
de Oliveira J.C.L.	Nummer et al. (2012)	Brazil	South America
de Sena I.S.	de Sena et al. (2012)	Brazil	South America
de Souza I.F.	de Borba et al. (2013)	Brazil	South America
de la Barre S.	de la Barre (2013)	Canada	North America
Del Lama E.A.	Mantesso-Neto et al. (2013)	Brazil	South America
Demissie M.	Asrat et al. (2012)	Ethiopia	East Africa
Desbois J.-L.	Desbois & Costabloz (2013)	France	Europe
di Gregorio F.	Di Gregorio et al. (2014)	Italy	Europe
Di Paola G.	Aucelli et al. (2013)	Italy	Europe
Dimitriou-Nikolakis P.	Fassoulas et al. (2012)	Greece	Europe
Ding Z.	Vasiljevic et al. (2014)	China	East Asia, Europe
do Nascimento E.R.	Salamuni et al. (2013)	Brazil	South America
do Nascimento M.A.L.	Lopes et al. (2012); Mantesso-Neto et al. (2012); Mansur et al. (2013); Mantesso-Neto et al. (2013)	Brazil	South America
dos Santos W.F.S.	dos Santos & Carvalho (2012); dos Santos & Carvalho (2013)	Brazil	South America
Dong H.	Dong et al. (2014)	China	East Asia
Dong Z.	Dong & Lv (2014)	China	East Asia
Dowling R.K.	Dowling (2012); Newsome et al. (2012); Dowling (2014a, 2014b); Norrish et al. (2014); Hurtado et al. (in press)	Australia	Australia, East Asia
Dryjanska L.	Dryjanska (2014)	Italy	Europe
Duley S.	Davis et al. (2013)	USA	Pacific Ocean
Ehsan S.	Ehsan et al. (2013)	Malaysia	
El-Asmar H.M.	El-Asmar et al. (2012)	Egypt, Saudi Arabia	North Africa
El-Masry N.	Moufti et al. (2013a); Moufti et al. (2013b)	Saudi Arabia	Middle East
Enemark J.	Marencic & Enemark (2012)	Germany	Europe
Enniouar A.	Enniouar et al. (2014)	Morocco	North Africa
Erdeli G.	Neches & Erdeli (in press)	Romania	Europe
Ergin A.	Rangel-Buitrago et al. (2013)	Turkey	South America
Esraghi M.	Eshraghi et al. (2012)	Malaysia	Middle East
Faccini F.	Faccini et al. (2012)	Italy	Europe
Fale P.	Lopes et al. (2013)	Portugal	Europe
Fan X.L.	Fan et al. (2014)	China	East Asia
Fard M.D.	Mashal et al. (2012)	Iran	Middle East
Farsani N.T.	Farsani et al. (2012); Farsani et al. (2014)	Portugal	Middle East
Fassoulas C.	Fassoulas et al. (2012)	Greece	Europe
Ferencikova J.	Strba et al. (in press)	Slovakia	
Ferreira A.C.	Pereira et al. (2012)	Brazil	South America
Ferreira da Silva E.	Rocha & Ferreirada Silva (in press)	Portugal	Atlantic Ocean
Ferrero E.	Magagna et al. (2013)	Italy	Europe
Ffejza I.	Avdullahi et al. (2013)	Serbia	Europe
Figueiredo M.A.	de Sena et al. (2012)	Brazil	South America
Fijalkowska-Mader A.	Fijalkowska-Mader & Malec (2013)	Poland	Europe
Filocamo F.	Amato et al. (2012); Aucelli et al. (2013)	Italy	Europe
Firpo M.	Faccini et al. (2012)	Italy	Europe
Fng W.	Cheung et al. (2014)	China	East Asia
Fok L.	Cheung et al. (2014)	China	East Asia
Forresu R.	Di Gregorio et al. (2014)	USA	Europe
Fraenza L.	Amato et al. (2012)	Italy	Europe
Frongi P.	Di Gregorio et al. (2014)	Italy	Europe
Fukami S.	Fukami (2013)	Japan	East Asia

Table 1 (*continued*)

Specialists	Citations	Countries of affiliation	Study regions[a]
Gajek G.	Warowna et al. (2014)	Poland	Europe
Galas A.	Paulo et al. (2014)	Poland	South America
Galas S.	Paulo et al. (2014)	Poland	South America
Galvan-Villa C.M.	Rios-Jara et al. (2013)	Mexico	North America
Galve J.P.	Coratza et al. (2012)	Italy	Europe
Gao Y.	Gao et al. (2013)	China	East Asia
Garcia J.C.	Martin-Duque et al. (2012)	Spain	Europe
Garcia M.G.M.	Garcia (2012); Nummer et al. (2012); Mantesso-Neto et al. (2013)	Brazil	South America
Garofano M.	Garofano (2012); Garofano & Govoni (2012); Mazzoleni et al. (2013)	Italy	Europe
Gawrysiak L.	Zglobicki et al. (2013); Zglobicki et al. (in press)	Poland	Europe
Ghadiri N.	Ghazi & Ghadiri (2012)	Iran	Middle East
Ghazi I.	Ghazi & Ghadiri (2012)	Iran	Middle East
Ghazi J.M.	Ghazi et al. (2013)	Iran	Middle East
Ghazi J.M. [2]	Ghazi et al. (2013)	Iran	Middle East
Giardino M.	Magagna et al. (2013)	Italy	Europe
Gladfelter S.	Gladfelter & Mason (2012)	USA	North America
Gonzalez-Delgado J.A.	Gonzalez-Delgado et al. (in press)	Spain	Europe
Gonzalez-Regalado M.L.	Gonzalez-Delgado et al. (in press)	Spain	Europe
Gordon J.E.	Gordon (2012a); Gordon (2012b)	UK	Europe
Gorska-Zabielska M.	Gorska-Zabielska (2013)	Poland	Europe
Gountie Dedzo M.	Zangmo Tefogoum et al. (2014)	Cameroon	Central Africa
Govoni D.	Garofano & Govoni (2012)	Italy	Europe
Goy J.L.	Martinez-Grana et al. (2013); Gonzalez-Delgado et al. (in press)	Spain	Europe
Guo Z.	Vasiljevic et al. (2014)	China	East Asia, Europe
Gutak J.M.	Bruno et al. (2014)	Russia	
Habib A.	Enniouar et al. (2014)	Morocco	North Africa
Harmon B.	Harmon & Viles (2013)	UK, USA	East Asia
He F.Y.	He et al. (2013)	China	East Asia
Henriques M.H.	Henriques et al. (2012); Henriques et al. (2013)	Portugal	Europe, South Africa
Hevia Riera J.	Hevia Riera (2014)	Venezuela[b]	South America
Hose T.A.	Hose (2012a); Hose (2012b); Hose & Vasiljevic (2012); Petrovic et al. (2013); Solarska et al. (2013); Vasiljevic et al. (2014)	UK	East Asia, Europe
Hou G.-L.	Xiao et al. (2013)	China	East Asia
Huff M.	Davis et al. (2013)	USA	Pacific Ocean
Hurtado H.	Hurtado et al. (in press)	Australia	Australia
Hvizdak L.	Strba et al. (in press)	Slovakia	
Iliopoulos G.	Fassoulas et al. (2012)	Greece	Europe
Jankowski L.	Krajpiec et al. (2012)	Poland	Europe
Jary A.	Solarska et al. (2013)	Poland	Europe
Johnson C.P.	Newsome & Johnson (2013)	India	Indian Ocean
Jurincic I.	Balazic et al. (2012)	Slovenia	Europe
Kagou Dongmo A.	Zangmo Tefogoum et al. (2014)	Cameroon	Central Africa
Kamel S.R.	Mashal et al. (2012)	Iran	Middle East
Kear B.P.	Sookias et al. (2013)	Sweden	Australia, East Asia, Europe, North America, South America
Khounchin S.	Mashal et al. (2012)	Iran	Middle East
Kiernan K.	Kiernan (2013)	Australia	East Asia
Kim A.K.	Kim & Brown (2013)	Australia	Australia
Kobryn H.	Rutherford et al. (in press)	Australia	Australia
Kok K.	Walliss & Kok (2014)	Australia	Australia
Kolodynska-Gawrysiak R.	Zglobicki et al. (2013); Warowna et al. (2014); Zglobicki et al. (in press)	Poland	Europe
Krajpiec M.	Krajpiec et al. (2012)	Poland	Europe
Krapiec P.	Krajpiec et al. (2012)	Poland	Europe
Krklec K.	Lozic et al. (2012)	Croatia	Europe
Krsak B.	Strba et al. (in press)	Slovakia	
Kucharska M.	Rychel et al. (2012)	Poland	
Lagnaoui A.	Enniouar et al. (2014)	Morocco	North Africa
Lan Y.	Wang et al. (2014)	China	East Asia
Lazzari M.	Lazzari (2013); Lazzari & Aloia (2014)	Italy	Europe
Leung Y.-F.	Newsome et al. (2012)	USA	Australia, East Asia
Li C.	Li (2012)	China	East Asia
Li F.	Li et al. (2013)	China	East Asia

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Table 1 (*continued*)

Specialists	Citations	Countries of affiliation	Study regions[a]
Li J.-F.	Gao et al. (2013)	China	East Asia
Li S.	Li et al. (2013)	China	East Asia
Liccardo A.	Liccardo et al. (2012)	Brazil	
Lilley K.	Bratton et al. (2013)	UK	
Lindsay J.M.	Moufti et al. (2013b)	New Zealand	Middle East
Liu B.L.	Luo et al. (2013)	China	
Liu S.W.	Fan et al. (2014)	China	East Asia
Liu X.	Vasiljevic et al. (2014)	Australia, China	East Asia, Europe
Lobo H.A.S.	Lobo & Boggiani (2013); Rodrigues Ferreira et al. (2013)	Brazil	South America
Logan C.	Davis et al. (2013)	USA	Pacific Ocean
Lokier S.W.	Lokier (2013)	UAE	Middle East
Lopes L.	Lopes et al. (2013)	Portugal	Europe
Lopes L.S.O.	Lopes et al. (2012)	Brazil	South America
Lopez-Uriarte E.	Rios-Jara et al. (2013)	Mexico	North America
Lorenzo B.	Sabatino et al. (2012)	Italy	Europe
Lozar F.	Magagna et al. (2013)	Italy	Europe
Lozic S.	Lozic et al. (2012)	Croatia	Europe
Lubova K.A.	Lubova et al. (2013)	Russia	Europe
Luciano C.	Sabatino et al. (2012)	Italy	Europe
Lukac M.	Strba et al. (in press)	Slovakia	
Lukic T.	Petrovic et al. (2013); Vasiljevic et al. (2014)	Serbia	East Asia, Europe
Luo W.	Luo et al. (2013); Yan et al. (2014)	China	East Asia
Lv P.	Dong & Lv (2014)	China	East Asia
Machado M.M.M.	Ruchkys & Machado (2013)	Brazil	South America
Magagna A.	Magagna et al. (2013)	Italy	Europe
Malec J.	Fijalkowska-Mader & Malec (2013)	Poland	Europe
Mancinelli V.	Miccadei et al. (2014)	Italy	Europe
Manosso F.C.	Pellitero et al. (in press)	Brazil	Europe, South America
Mansur K.L.	Mantesso-Neto et al. (2012); Mansur et al. (2013)	Brazil	South America
Mantesso-Neto V.	Liccardo et al. (2012); Mantesso-Neto et al. (2012); Mantesso-Neto et al. (2013)	Brazil	South America
Mao L.	Luo et al. (2013); Yan et al. (2014)	China	East Asia
Marencic H.	Marencic & Enemark (2012)	Germany	Europe
Margielewski W.	Krajpiec et al. (2012)	Poland	Europe
Markovic S.B.	Petrovic et al. (2013); Solarska et al. (2013); Vasiljevic et al. (2014)	Serbia	East Asia, Europe
Martin-Duque J.F.	Martin-Duque et al. (2012)	Spain	Europe
Martinez-Grana A.M.	Martinez-Grana et al. (2013); Gonzalez-Delgado et al. (in press)	Spain	Europe
Martins R.	Lopes et al. (2013)	Portugal	Europe
Mashal M.	Mashal et al. (2012)	Iran	Middle East
Mashal M. [2]	Mashal et al. (2012)	Iran	Middle East
Mason R.J.	Gladfelter & Mason (2012)	USA	North America
May V.	May (in press)	UK	Europe
Mazzoleni G.	Mazzoleni et al. (2013)	Italy	Europe
McCallum A.	McCallum & O'Brien (2012)	Canada	North America
McKinley J.	Bratton et al. (2013)	UK	
Mehbaliyev M.M.	Mehbaliyev (2013)	Azerbaijan	Europe
Mera O.	Bican-Brisan et al. (2013)	Romania	Europe
Miccadei E.	Miccadei et al. (2014)	Italy	Europe
Migon P.	Migon (2012a); Migon (2012b)	Poland	East Asia, Europe
Mizusaki A.M.P.	de Borba et al. (2013)	Brazil	South America
Mogessie A.	Asrat et al. (2012)	Austria	East Africa
Molokac M.	Strba et al. (in press)	Slovakia	
Moradi A.	Mashal et al. (2012)	Iran	Middle East
Morczek P.	Solarska et al. (2013)	Poland	Europe
Moreira J.C.	Moreira (2012)	Brazil	South America
Moroni A.	Bruno et al. (2014)	Italy	
Moufti M. R.	Moufti & Nemeth (2013); Moufti et al. (2013a); Moufti et al. (2013b)	Saudi Arabia	Middle East
Mouriki D.	Fassoulas et al. (2012)	Greece	Europe
Muchova L.	Strba et al. (in press)	Slovakia	
Mugge-Bartolovic V.	Wrede & Mugge-Bartolovic (2012)	Germany	Europe
Mulec I.	Mulec & Wise (2012)	Serbia	Europe
Munoz-Fernandez V.T.	Rios-Jara et al. (2013)	Mexico	North America
Murcia H.	Moufti et al. (2013b)	New Zealand	Middle East
Nazarenko O.V.	Bruno et al. (2014)	Russia	
Neches I.-M.	Neches (2013); Neches & Erdeli (in press)	Romania	Europe
Nemeth K.	Moufti & Nemeth (2013); Moufti et al. (2013a); Moufti et al. (2013b)	New Zealand, Saudi Arabia	Middle East

Table 1 (*continued*)

Specialists	Citations	Countries of affiliation	Study regions[a]
Neto F.M.	Ribeiro et al. (in press)	Brazil	South America
Newsome D.	Newsome et al. (2012); Newsome & Johnson (2013)	Australia	Australia, East Asia. Indian Ocean
Nickerson N.P.	Boley & Nickerson (2013)	USA	
Nita J.	Nita (2013)	Poland	Europe
Nkouathio D.G.	Zangmo Tefogoum et al. (2014)	Cameroon	Central Africa
Norrish L.	Norrish et al. (2014)	Australia	Australia
Nummer A.R.	Nummer et al. (2012)	Brazil	South America
O'Brien S.	McCallum & O'Brien (2012)	Canada	North America
Oheim K.B.	Bruno et al. (2014)	USA	
Olafsdottir R.	Ghazi et al. (2013)	Iceland	Middle East
Ollier C.	Ollier (2012)	Australia	
Ostanello M.C.P.	Ostanello et al. (2012)	Brazil	South America
Packer J.	Xu et al. (2013)	Australia	East Asia
Palacio-Prieto J.L.	Palacio-Prieto (2013; in press)	Mexico	North America
Pasqua C.	Mazzoleni et al. (2013)	Italy	Europe
Passos J.	Lopes et al. (2013)	Portugal	Europe
Paulo A.	Paulo et al. (2014)	Poland	South America
Pavia G.	Zunino et al. (2012)	Italy	Europe
Pawlowski A.	Zglobicki et al., 2012	Poland	Europe
Pedreira A.	Mansur et al. (2013)	Brazil	South America
Pelfini M.	Bollati et al. (2013); Pelfini & Bollati (2014)	Italy	Europe
Pellino R.	Amato et al. (2012)	Italy	Europe
Pellitero R.	Pellitero et al. (in press)	UK	Europe, South America
Peng P.H.	He et al. (2013)	China	East Asia
Pereira M.B.	Pereira et al. (2012)	Brazil	South America
Pereira M.F.	Lopes et al. (2013)	Portugal	Europe
Perica D.	Lozic et al. (2012)	Croatia	Europe
Perinotto A.R.C.	Brito & Perinotto (2012)	Brazil	South America
Perinotto J.A.	Rodrigues Ferreira et al. (2013)	Brazil	South America
Perotti L.	Magagna et al. (2013)	Italy	Europe
Perrotta P.	Bruno & Perrotta (2012)	Italy	Europe
Petrea D.	Bican-Brisan et al. (2013)	Romania	Europe
Petrovic M.D.	Petrovic et al. (2013)	Serbia	Europe
Piacente S.	Badiali & Piacente (2012)	Italy	Europe
Piacentini D.	Bruschi et al. (2012)	Italy	Europe
Piacentini T.	Miccadei et al. (2014)	Italy	Europe
Piekarz G.F.	Liccardo et al. (2012); Mansur et al. (2013)	Brazil	South America
Piras G.	Di Gregorio et al. (2014)	Italy	Europe
Pochocka-Szwarc K.	Rychel et al. (2012)	Poland	
Poggi E.	Poggi et al. (2013)	Italy	Europe
Poggi F.	Poggi et al. (2013)	Italy	Europe
Poros M.	Poros & Sobczyk (2013)	Poland	Europe
Pratt S.E.	Pratt (2012)	USA	
Qaddah A.	Moufti et al. (2013a)	Saudi Arabia	Middle East
Queirolo C.	Poggi et al. (2013)	Italy	Europe
Queiroz G.L.	Salamuni et al. (2013)	Brazil	South America
Rangel-Buitrago N.	Rangel-Buitrago et al. (2013)	Spain	South America
Reynard E.	Bosson & Reynard (2012); Reynard & Coratza (2013)	Switzerland	Europe
Ribeiro L.C.B.	Ribeiro et al. (in press)	Brazil	South America
Ribeiro R.R.	Mansur et al. (2013); Mantesso-Neto et al. (2013)	Brazil	South America
Rios-Jara E.	Rios-Jara et al. (2013)	Mexico	North America
Roberto P.	Sabatino et al. (2012)	Italy	Europe
Roccati A.	Faccini et al. (2012)	Italy	Europe
Rocha A.J.D.	Mansur et al. (2013)	Brazil	South America
Rocha F.	Rocha & Ferreirada Silva (in press)	Portugal	Atlantic Ocean
Rocha L.C.	de Sena et al. (2012); Pereira et al. (2012)	Brazil	South America
Rodela L.G.	Nummer et al. (2012)	Brazil	South America
Rodrigues Ferreira A.R.	Rodrigues Ferreira et al. (2013)	Brazil	South America
Rodrigues G.S.S.C.	Bento et al. (2012)	Brazil	South America
Rodrigues S.C.	Bento et al. (2012)	Brazil	South America
Rodriguez-Zaragoza F.A.	Rios-Jara et al. (2013)	Mexico	North America
Rosskopf C.M.	Aucelli et al. (2013)	Italy	Europe
Ruban D.A.	Lubova et al. (2013); Bruno et al. (2014)	Austria, Russia	Europe
Ruchkys U.A.	Mantesso-Neto et al. (2012); Ruchkys & Machado (2013)	Brazil	South America
Ruiz F.	Gonzalez-Delgado et al. (in press)	Spain	Europe
Rutherford J.	Rutherford et al. (in press)	Australia	Australia

(*continued on next page*)

Table 1 (*continued*)

Specialists	Citations	Countries of affiliation	Study regions[a]
Rybar P.	Strba et al. (in press)	Slovakia	
Rychel J.	Rychel et al. (2012)	Poland	
Sa A.A.	Henriques et al. (2012)	Portugal	Europe
Sabatino C.	Sabatino et al. (2012)	Italy	Europe
Sahebari S.S.	Mashal et al. (2012)	Iran	Middle East
Sajinkumar K.S.	Sajinkumar (2012)	India	South Asia
Salamuni E.	Mansur et al. (2013); Salamuni et al. (2013)	Brazil	South America
Sammarone L.	Miccadei et al. (2014)	Italy	Europe
Sanders D.	Norrish et al. (2014); Hurtado et al. (in press)	Australia	Australia
Schobbenhaus C.	Mansur et al. (2013)	Brazil	South America
Searle M.P.	Searle (2014)	UK	Middle East
Serjani A.	Avdullahi et al. (2013)	Albania	Europe
Serrano E.	Pellitero et al. (in press)	Spain	Europe, South America
Shafeealeman M.	Ehsan et al. (2013)	Malaysia	
Shimada H.	Shimada (2013)	Brazil	South America
Sierro F.J.	Gonzalez-Delgado et al. (in press)	Spain	Europe
Sinkovic L.	Balazic et al. (2012)	Slovenia	Europe
Sinnyovsky D.	Tronkov & Sinnyovsky (2012)	Bulgaria	Europe
Siuda R.	Siuda & Borzecki (2014)	Poland	Europe
Smalley I.	Vasiljevic et al. (2014)	UK	East Asia, Europe
Smiraglia C.	Bollati et al. (2013)	Italy	Europe
Smith B.	Bratton et al. (2013)	UK	
Sobczyk W.	Poros & Sobczyk (2013)	Poland	Europe
Solarska A.	Solarska et al. (2013)	Poland	Europe
Soldati M.	Bruschi et al. (2012); Coratza et al. (2012)	Italy	Europe
Song J.	Wang et al. (2014)	China	East Asia
Song Y.	Dong et al. (2014)	China	East Asia
Sookias R.B.	Sookias et al. (2013)	Germany, Sweden	Australia, East Asia, Europe, North America, South America
Spacek J.	Spacek & Antouskova (2013)	Czech Republic	Europe
Stachowiak J.	Zwolinski & Stachowiak (2012)	Poland	Europe
Strba L.	Strba et al. (in press)	Slovakia	
Stumpf P.P.	de Borba et al. (2013)	Brazil	South America
Sun J.H.	Sun (2014)	China	East Asia
Sun M.	Wang et al. (2014)	China	East Asia
Sun M. [2]	Wang et al. (2014)	China	East Asia
Taha M.M.N.	El-Asmar et al. (2012)	Egypt	North Africa
Tang Z.-X.	Xiao et al. (2013)	China	East Asia
Tavares A.O.	Henriques et al. (2013)	Portugal	South Africa
Telecka M.	Warowna et al. (2014)	Poland	Europe
Theodorovicz D.	Mantesso-Neto et al. (2013)	Brazil	South America
Thomas M.F.	Thomas (2012)	UK	
Tian M.Z.	Fan et al. (2014); Wang et al. (2014)	China	East Asia
Tiess G.	Lubova et al. (2013); Bruno et al. (2014)	Austria	Europe
Tmava A.	Avdullahi et al. (2013)	Serbia	Europe
Tomaz C.	Henriques et al. (2012)	Portugal	Europe
Tometzova D.	Strba et al. (in press)	Slovakia	
Tomic N.	Tomic & Bozic (2014)	Serbia	Europe
Tonelli C.	Coratza et al. (2012)	Italy	Europe
Tongkul F.	Ghazi et al. (2013)	Malaysia	Middle East
Toriman M.E.	Eshraghi et al. (2012)	Malaysia	Middle East
Tronkov D.	Tronkov & Sinnyovsky (2012)	Bulgaria	Europe
Turner S.	Turner (2013)	Australia, Canada	Australia, East Asia, Europe, Middle East
Urban J.	Krajpiec et al. (2012)	Poland	Europe
Urqui L.C.	Martin-Duque et al. (2012)	Spain	Europe
Valletta M.	Amato et al. (2012)	Italy	Europe
Vasiljevic D.A.	Hose & Vasiljevic (2012); Petrovic et al. (2013); Solarska et al. (2013); Vasiljevic et al. (2014)	Serbia	East Asia, Europe
Venzal C.	Venzal (2013)	France	Europe
Verrillo C.	Amato et al. (2012)	Italy	Europe
Viles H.	Harmon & Viles (2013)	UK	East Asia
Vincenzo A.	Sabatino et al. (2012)	Italy	Europe
Vujicic M.D.	Petrovic et al. (2013); Vasiljevic et al. (2014)	Serbia	East Asia, Europe
Walliss J.	Walliss & Kok (2014)	Australia	Australia
Wandji P.	Zangmo Tefogoum et al. (2014)	Cameroon	Central Africa

Table 1 (*continued*)

Specialists	Citations	Countries of affiliation	Study regions[a]
Wang H.	Wang et al. (2014)	China	East Asia
Wang L.-L.	Wang & Tian (2013); Wang et al. (2014)	China	East Asia
Wang M.	Gao et al. (2013)	China	East Asia
Wang X.	Li et al. (2013)	China	East Asia
Wang Y-H.	Wang et al. (2013)	China	East Asia
Warowna J.	Warowna et al. (2014)	Poland	Europe
Wasiluk R.	Wasiluk (2013)	Poland	Europe
Wen X.	Wang et al. (2014)	China	East Asia
Widawski K.	Solarska et al. (2013)	Poland	Europe
Williams A.T.	Rangel-Buitrago et al. (2013)	UK	South America
Winge M.	Mansur et al. (2013)	Brazil	South America
Wise N.	Mulec & Wise (2012)	USA	Europe
Wrede V.	Wrede & Mugge-Bartolovic (2012)	Germany	Europe
Wu F.-D.	Wang et al. (2013)	China	East Asia
Wu L.	Li et al. (2013)	China	East Asia
Xiao J.-Y.	Xiao et al. (2013)	China	East Asia
Xu H.	Xu et al. (2013)	China	East Asia
Xu Y.-Y.	Wang et al. (2013)	China	East Asia
Yan Z.W.	Luo et al. (2013); Yan et al. (2014)	China	East Asia
Yu L.	Dong et al. (2014)	China	East Asia
Zagozdzon K.D.	Zagozdzon & Zagozdzon (2013)	Poland	Europe
Zagozdzon P.P.	Zagozdzon & Zagozdzon (2013)	Poland	Europe
Zangmo Tefogoum G.	Zangmo Tefogoum et al. (2014)	Cameroon	Central Africa
Zayats P.P.	Lubova et al. (2013)	Russia	Europe
Zglobicki W.	Zglobicki et al., 2012; Zglobicki & Baran-Zglobicka (2013); Warowna et al. (2014); Zglobicki et al. (in press)	Poland	Europe
Zhang Y.	He et al. (2013)	China	East Asia
Zhang Y.-Z.	Xiao et al. (2013)	China	East Asia
Zhao J.	Dong et al. (2014)	China	East Asia
Zhao L.	Wang et al. (2014)	China	East Asia
Zhou X.-W.	Gao et al. (2013)	China	East Asia
Zhu C.	Li et al. (2013)	China	East Asia
Zhu J.-J.	Xiao et al. (2013)	China	East Asia
Zielinski P.	Warowna et al. (2014)	Poland	Europe
Zorina S.O.	Bruno et al. (2014)	Russia	
Zunino M.	Zunino et al. (2012)	Italy	Europe
Zwolinski Z.	Asrat & Zwolinski (2012); Zwolinski & Stachowiak (2012)	Poland	Europe

[a] Some published articles are theoretical and do not focus on any region.
[b] Unclear indication of the specialist's affiliation.

regions, and 2) the proportions between geotourism research in different countries and different parts of the world. The idea of geotourism research as an international academic activity is confirmed by the active collaboration among specialists. On the one hand, one journal article published in 2012–2014 was authored by 2–3 specialists on average (417 specialists, 165 articles, the ratio is 2.53), and some papers have more than 3 authors (see Table 1 and the list of references). On the other hand, several multi-authored articles were written by specialists from different countries, including those located far from one another (Table 1). Typical examples include the UK-Serbian-Polish-Chinese collaborative studies (Hose & Vasiljevic, 2012; Petrovic et al., 2013; Solarska et al., 2013; Vasiljevic et al., 2014) and the project realized by the author of the present paper (Bruno et al., 2014). If individual specialists in geotourism are active only in some countries, they often collaborate with researchers in this field from the other countries (e.g., Asrat & Zwolinski, 2012). It should be noted that research networks are also emerging on national scales that are especially typical for Brazil in South America and Italy in Europe (see Table 1 and the list of references). This is significant because the proportional world distribution of research also reflects the existence of several more or less independent "centers" in different countries and in different parts of the world. Examples of individual research in such "centers" can be found, particularly, in Mexico (Palacio-Prieto, 2013, in press) and Romania (Neches, 2013; Neches & Erdeli, in press).

4. Discussion

The documented geographical pattern of current geotourism research needs proper explanation. Five hypotheses can be proposed for this purpose (Table 3). The results of the present study permit some degree of verification, and, thus, the validity of each hypothesis is discussed below.

Hypothesis 1 may explain the high or relatively high number of specialists in geotourism in some European countries (e.g., Italy) and Brazil (Fig. 2), where there are many universities and other research institutions. However, the very large number of universities in North America does not lead to any extraordinary rise in geotourism research. The same is true for India and Turkey. The very large research community of Argentina cannot boast to any degree of participation in geotourism research during the past three years.

If Hypothesis 2 is valid, geotourism research should be concentrated in the United Kingdom, where its has been conducted since the very beginning (Hose, 2000; Hose & Vasiljevic, 2012). In fact, the number of specialists in geotourism is large there, but not as large as in some other countries like Brazil or China (Fig. 3). Moreover, there are countries where geotourism research is something novel (countries of Africa, the Middle East, North America, and South America), where it has been conducted actively during the past three years (Fig. 3). The only confirmation of this hypothesis is as follows. Current geotourism

Table 2
Countries of affiliation of specialists published journal articles on geotourism in 2012–2014.

Country	Number of specialists
Albania	1
Angola	1
Australia	17
Austria	4
Azerbaijan	1
Brazil	59
Bulgaria	2
Cameroon	5
Canada	4
Chile	1
China	52
Colombia	2
Croatia	3
Czech Republic	2
Egypt	4
Ethiopia	2
France	4
Germany	5
Greece	4
Iceland	1
India	2
Iran	12
Italy	61
Japan	4
Jordan	1
Malaysia	7
Mexico	6
Morocco	3
New Zealand	3
Poland	38
Portugal	16
Romania	6
Russia	6
Serbia	11
Saudi Arabia	5
Slovakia	10
Slovenia	3
Spain	16
Sweden	3
Switzerland	2
Turkey	1
United Arab Emirates	1
United Kingdom	17
United States of America	18
Venezuela[a]	1

[a] Unclear indication of the specialist's affiliation.

research concentrates in Europe (Figs. 2,3, and this region taken as a whole has a long tradition of such a research (Hose, 2000; Hose & Vasiljevic, 2012)).

At first glance, Hypothesis 3 is easy to verify. As suggested by: 1) articles selected for the purposes of this study (see Table 1 and the list of references), 2) analysis of regional, national, and international initiatives (Dowling & Newsome, 2010; Newsome & Dowling, 2010), and 3) distribution of geoparks (see on-line: unesco.org/en/natural-sciences/environment/earth-sciences/geoparks/some-questions-about-geoparks/where-are-the-global-geoparks/and europeangeoparks.org), where more or less intense geotourism research is significant in China, Europe, and many countries/regions with recognizable geotourism activity (Figs. 2,3). However, one should note two exclusions. First, numerous geology-based national parks, national monuments (see reviews in Klein, 2002; Squillace, 2003), and state parks in the USA have attracted crowds of visitors since the end of the 19th century. Besides the famous Yellowstone National Park, typical examples include (but, of course, are not limited to) Diamond Head in Honolulu (Hawaii) and Stone Mountain in Atlanta (Georgia). If so, why is academic geotourism research in the USA so rare (Figs. 2,3)? Second, somewhat more specialists attempted geotourism studies in Africa than in Australia and North America, but it is improbable that the intensity of geotourism activity in those parts of the world is in any way comparable.

Hypothesis 4 may explain an interest by researchers in geotourism studies in Brazil or Australia. But such large countries with complex and diverse geological environments and a long history of mining and geological exploration as found in Argentina, India, Russia, Thailand, and the USA cannot boast of significant geotourism research communities (Fig. 2) and related attention of researchers (Fig. 3). Speaking of Europe, one would expect attention to geotourism in Austria, France, and Switzerland, where the richness of the "classical" Alpine geology is almost unlimited (Pfiffner, 2014), but this is not documented in fact (Fig. 2). A simple comparison of the recognized geological heritage sites of Europe (Wimbledon et al., 1998) and the results of the present study (Table 1, Fig. 2) do not reveal any strong relationship.

Hypothesis 5 cannot be tested fully at this stage (alternatively, a detailed sociological survey would be required). However, one should note how quickly that the research communities and individual specialists from Australia, Brazil, China, Iran, Mexico, Malaysia, and some other countries have become aware of geotourism research and have started their own relevant projects. This result surely implies a readiness for innovation. A matter for further thought is whether doing innovative research may be interpreted in terms of a struggle for discipline leadership that depends on science productivity (Parker & Welch, 2013). Winning in such a struggle seems to be easier in emerging disciplines.

Generally, all five hypotheses have some merit for explanation of the current world distribution of geotourism research (Table 3). However, none can provide an ultimate explanation. This suggests an inherent puzzle among all the factors that influence the global rise of new scientific disciplines. The available knowledge on how and why modern tourism research develops (Ren et al., 2010) makes sensible still additional hypothesis. It cannot be excluded that the globalization of modern science, itself, enhances the international development of geotourism research, even if such a proposition has its own limitations (Racherla & Hu, 2010).

5. Conclusion

The attempted analysis of journal articles on geotourism published in 2012–2014 permits an arrival at three conclusions. First, geotourism research is concentrated in Europe (mainly in Italy and Poland), Asia (mainly, in China and Iran), and South America (mainly, in Brazil). Second, geotourism research is being conducted on a global scale. Third, no single explanation for the world distribution of geotourism research can be proposed. Generally, the results of the present study demonstrate that the rising scientific discipline balances between concentration in particular "centers" and global "deconcentration" as suggested by the distribution of the both research communities and regional research focus.

Further studies should answer the question whether the innovative nature of geotourism research represents a development different from that of the entire body of modern research on tourism (Racherla & Hu, 2010; Ren et al., 2010). The analysis of the current geographical pattern of geotourism research has also a practical implication permitting insight on some challenges of the latter.

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Fig. 2. Global geotourism research community. The number of specialists' published journal articles on geotourism in 2012–2014 per countries of affiliations. See Table 2 for details.

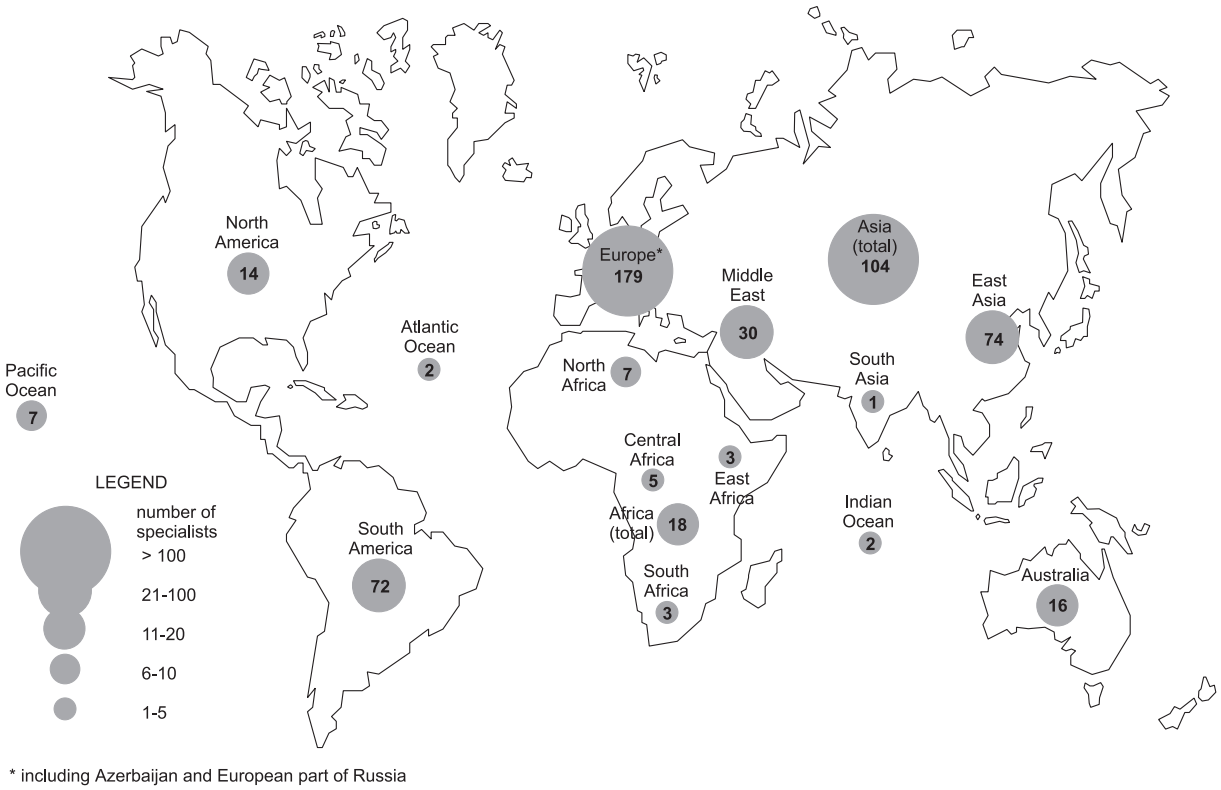

Fig. 3. Regional focus of geotourism research. The number of specialists' published journal articles on geotourism in 2012–2014 per study regions.

Table 3
Possible explanations of the current world distribution of geotourism research documented with the present bibliographical survey.

Hypothesis	Foundation	Verification[a]
1. Geotourism research is concentrated in countries/regions with larger academic systems.	Larger academic system means larger research community. As a result, the probability that one specialist from there will be interested in geotourism is higher.	Partial
2. Geotourism research is concentrated in countries/regions with longer traditions of such a research.	Longer tradition of geotourism research has permitted to establish working groups and research infrastructure on permanent basis.	Minimal
3. Geotourism research is developed and is concentrated in countries/regions with significant geotourism activity.	Significant geotourism activity provides better material for its scientific investigation.	Partial
4. Geotourism research is concentrated in countries/regions with richer geotourism resources.	Larger territory, complex and diverse geological environment, long history of mining and geological exploration are premises for geotourism development. Potential exploitation of richer geotourism resources attract more attention.	Minimal
5. Geotourism research is concentrated in countries/regions with research communities ready for innovations.	Academic awareness of new ideas, enthusiasm, and understanding of benefits from doing new research are favorable conditions for geotourism studies.	Partial

[a] Based on the results of the present study; see text for details.

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