



Review article

מאמר סקירה

Geography of religious traditions

The beginning of scientific study of the Dead Sea¹

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1. The Dead Sea

Near Sodom, on the beach of the Dead Sea, William Holman Hunt (1827–1910) spent seventeen days on his famous painting "The Scapegoat". Holt sought to capture the singular atmosphere of this background to the painting of the goat that, according to the Bible, was sent to the desert carrying the sins of the People of Israel in a yearly ritual performed by the High Priest (Ben-Arieh, 1997).

Holt was not the only one to be affected by the unique area:

It was indeed a scene of unmitigated desolation [...] The glare of the light was blinding the eye, and the atmosphere difficult of respiration. No bird fanned with its wing the attenuated air through which the sun poured its scorching rays upon the mysterious element on which we floated, and which, alone, of all the works of his Maker, contains no living thing within it. While in full view of the peninsula, I named its northern extremity "Point Costigan", and its southern one "Point Molyneux", as a tribute to the memories of the two gallant Englishmen who lost their lives in attempting to explore this sea (Lynch, 1849, 310–311).

On Wednesday, 26th April 1848, about noontime, while sailing in the shallow water of the southern portion of the Dead Sea, William Francis Lynch (1801–1865), architect and commander of "The United States Expedition to the River Jordan and the Dead Sea", took the opportunity to honour the memory of the two pioneer researchers of the Jordan River and

the Dead Sea. Both lost their lives sailing on the lake waters in an attempt to uncover its secrets. Lynch was clearly inspired to memorialize his predecessors. His words were motivated, perhaps, by biblical accounts and a visceral connection to the deeds performed by the Creator, or by the dark and mysterious mood inspired by the lake and its desolate, mountainous surroundings. Alternatively, his words may simply have been the outcome of a carefully considered, gallant and almost scientific decision. Of course, all three factors may have motivated this rather dramatic tribute.

In the words of a contemporary writer (Perrin, 1988, 8), the river Jordan was "more famous than the Mississippi or the Amazon, though infinitely smaller than either". The Jordan and its two lakes were the setting for many significant events described in the Old and New Testaments. After visiting Jericho and the traditional site of the Baptism in the Jordan, the Christian pilgrim continued the short distance south to its opening into the Dead Sea, to search for evidence of narratives in the book of Genesis. Of special interest were Abraham, Lot and Sodom and Gomorrah, the Cities of the Plain destroyed by divine punishment. These biblical narratives had an everlasting effect on nearly all travelers who embarked on the long and dangerous trip from Jerusalem. They traversed the northwestern shore of the Dead Sea all the way to the entrance to the canyon of Wadi Kidron, climbed up the canyon to the Greek-Orthodox Monastery of Mar-Saba (St. Saba), and then returned to Bethlehem and Jerusalem. This has never been a simple undertaking, neither in the Byzantine Period, nor in the nineteenth century. Everyone who set out, pilgrim, traveler or strict scientist, was deeply affected:

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Solemn ride along this briny strand! [...] The burning and vanishing ground, with its doomed cities, comes up vividly before the mind. What a tract of country! What a terrible witness to the righteous vengeance of God's justice! (Van de Velde, 1854, II, 124–125).

These lines are quite typical expressions of the impressions that the region left upon its visitors. They were, however, expressed not by a devoted pilgrim of the Middle Ages, but by one of the leading cartographers of Palestine in the middle of the nineteenth century. The Dutch naval officer Carel Willem Meredith van de Velde (1818–1898) began his scientific career in the Dutch East Indies mapping the Island of Java. Being a pious Protestant, he decided after retiring from the army to use his talents and experience in support of the study of the Holy Land, and explored and measured it twice, first in 1851/2 and again in 1861/2 (de Vries, 1996; Perthus and Faehndrich, 2013; Goren and Schelhaas, 2015). He published a huge volume of paintings, a two-volume description of his voyage (van de Velde, 1854) and, most important, a map of the entire country on a scale of one half inch to a mile. This remained the most accurate and advanced map until the big "Survey of Western Palestine" performed by the English Palestine Exploration Fund during the 1870's (van de Velde, 1858a, 1858b; Perthus and Faehndrich, 2013).

Van de Velde was a faithful representative of his fellow European scientists who studied the Holy Land. Modern research usually marks the second half of the eighteenth century as the start of exploration, or, to use the more common term concerning the Holy Land, rediscovery (Ben-Arieh, 1979; Goren, 1998, 2003). Palestine's explorers of the new era differed from those who went to study other countries in one primary aspect, in the geopious influence that the subject of their studies had on their research. It was obvious that no one could ignore the uniqueness of Palestine, the "Holy Land", with all its implications (Wright, 1966).

This paper continues the research reported in earlier publications by the author concerning the history and development of the rediscovery and early scientific study of the Jordan Rift Valley and the Dead Sea (Goren, 1997, 1998, 2003, 2004, 2008, 2009, 2011). It aims to describe this explorative-scientific process and connect it to larger issues. One issue, presented primarily as backdrop to the history of the scientific process, is its place within geo-political interests and developments in the Near East during the first half of the nineteenth century (Goren, 2011). The second issue is the phenomenon of geopious (or even better georeligious) beliefs as a motivating force for the scientific study, and as affecting

the involved fields and methods for studying one of the most "arousing geopious areas" in Palestine, the river Jordan and its two lakes, "places where the divine becomes manifest to the eyes of the believers, and were cherished or revered or concrete, tangible, spatially defined testimonies to the reality of the divine [...]" (Werblowsky, 1983, 1).

The participants who undertook this scientific adventure did their best to perform their study according to the high scientific standards of their time, but they could not avoid the religious connection, and it strongly influenced the objects and topics they chose to investigate. The French romantic writer, traveler and diplomat, François René de Chateaubriand (1768–1848), who visited the Holy Land in the beginning of the nineteenth century and started a genre of romantic Palestine-literature, tried to resolve the obvious contradiction. Following some leading eighteenth century scholars, he claimed that physics may be admitted in the catastrophe of the guilty cities of Sodom and Gemorrah without offence of religion (Chateaubriand, 1856; cf. Gollwitzer, 1948; Said, 1978).

2. The Dead Sea: Curiosities, questions

Nonetheless, the primary questions in the study of the Dead Sea at that time derived from its Scriptural descriptions and from the curious characteristics and phenomena attached to it. The earliest explorers searched for the lost cities and for existing signs of the catastrophe that God wrought in divine wrath. They posited that the destructive event might also explain the fact that even though the Jordan and more tributaries flow into the Dead Sea without any visible outlet, the water level remains constant. They asked whether the Jordan previously ran into the Red Sea. If the answer was positive, then the change must have been due to the same catastrophe. They asked further whether there was an underground connection between the Dead Sea and the Red Sea or between the Dead Sea and the Mediterranean.

Many of the facts that are known today, the facts that are behind the geographical and chemical uniqueness of the Dead Sea, still waited to be established. Then, of course, nobody knew, or at least reported, that the surface of the Dead Sea is much lower than "sea level", and that it is actually the lowest point on earth not covered by water. What they did know and tried to verify and understand were facts, or sometimes romantic speculations, which were based on the writings of early historians and geographers, and on many pilgrims' descriptions.

One of these mysterious facts was the buoyancy of the Dead Sea water. This buoyancy was connected to the salty environment of the lake and its surroundings. Naturally, it reminds us of the biblical story of Lot's wife who was turned

into a pillar of salt, and of the fact that in Hebrew the Dead Sea is called "Yam Hamelach" (Sea of Salt). Another common belief held at the time was that no living creatures existed in its waters and that birds attempting to fly over it would be suffocated from the vapors and fall dead. The explorers who reached its shores were familiar with these stories and traditions, and they formed the basis for their research questions. Others searched for explanations for the creation of bulks of bitumen which also gave the sea the name "Lake Asphaltis". Josephus and Strabo claimed that with the overthrow of Sodom, the whole valley became the Lake Asphaltites. The various names appear in many of the maps of the lake, as the one drawn in 1532 by the German scholar Jacob Ziegler (c. 1470–1539) (Laor and Klein, 1986; Bekenmeyer, 1993).

I would go so far as to argue that these special characteristics of the Dead Sea and its surroundings determined which scientists would focus their studies on the region. Almost every researcher of Palestine included the Jordan depression in his itinerary. But those who chose the Dead Sea as their primary object of study were motivated by a common and strong, religious belief, by a georeligious attitude to the area, as place and as past, that influenced their study. It seems that they shared a strong need to decipher its secrets, in order to verify the stories and physical descriptions in the scriptures.

The first Dead Sea explorers, including the German Ulrich Jasper Seetzen (1767–1811), who in early 1807 was the first European on record to succeed in traveling around the entire lake, and the Swiss Johann Ludwig Burckhardt (1784–1817), who rediscovered Petra in 1812, did not intend to concentrate on studying the Dead Sea or the Jordan Depression; they pursued their exploration as part of a larger project (Syria and Palestine were for Seetzen and Burckhardt only training grounds for their exploration of the inner regions of Africa) (Ben-Arieh, 1972b; 1979; Schäbler, 1995; Schienerl, 2000; Goren, 2003). Yet, we owe Seetzen the credit for drafting the first map of the depression including the Dead Sea (figure 1), which he based on personal observations:

In order to make my diary more comprehensible,[...], I decided in Jerusalem to draw a map of the countries lying around the sources of the Jordan, its eastern side and the Dead Sea; but I lacked my diaries, which were forwarded to Egypt [...]. So I had to limit myself to the preparation only of a map of the Dead Sea [...] (Seetzen, 1810; Lindenau, 1810).

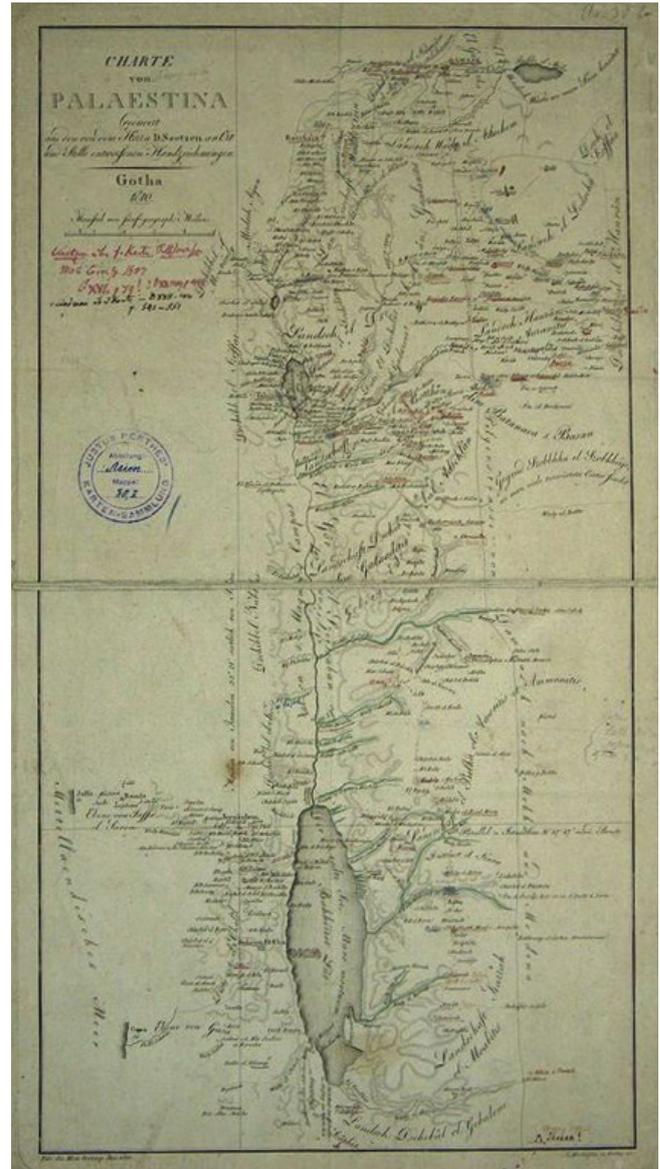


Figure 1: Seetzen 1810 (Universitäts- und Forschungsbibliothek Erfurt/Gotha, Sammlung Perthes, Kartensammlung, Asien, 30 II)

All the maps preceding Seetzen's were compiled using historical sources, and included mostly imaginary geographical details. A typical example of these "historical" maps of the Middle Ages is one compiled and published in 1593 by Gerard de Jode (1509–1591), cartographer, engraver and publisher. It depicts the five burning cities and other testimonies to the deeds of the Creator. The outline of the Dead Sea is merely a technical framework for the beliefs that are depicted on the map (Laor and Klein, 1986; Tishbi, 2001). Even the more scientific, geographical contemporary maps from the mid-eighteenth century still suffer from a total lack of data. Jean-Baptiste Bourguignon d'Anville (1697–1782), a French "armchair geographer" and cartographer, compiled various maps of the region from 1750–1780 using the best available historical and

contemporary sources (Godlewska, 1999). The results of his compilations are convincing proof of the complete lack of data concerning almost every cartographical issue in the country, including those of the Jordan Rift Valley and its lakes (d'Anville, 1771; cf. Fischer, 1939/40) (figure 2).



Figure 2: d'Anville, Map of Palestine, 1767 (Palaestina, by Mons. D'Anville [...] in June 1767, [London], [1771], The National Library of Israel, Eran Laor Cartographic Collection)

Nevertheless, the middle of the eighteenth century did see the beginnings of scientific studies of the lake that attempted to resolve some of the recurrent questions concerning its curiosities. In 1722, the English chaplain and scientist Thomas Shaw (1694–1751) rejected the theory of the existence of an underground outlet for the waters of the Dead Sea. According to his calculations, "the Dead-Sea alone will lose every day, near one third more in vapor, than what all this amounts to". Shaw brought biblical verses in support of his physical explanation of the phenomenon:

For all and every one of these, by receiving as much water from their respective rivers, as they lose in vapor, will preserve, as near as can be expected, their usual limits and dimensions: the Almighty providence having given to them, no less to the elements, a law which shall not be broken, (Ps. cxlviii. 6.) Which has said (Job xxxviii. 11.) to the sea, Hitherto shalt thou come and no further; and here shall thy proud waves be staid (Shaw, 1757, 346).

One of the most learned and well-arranged descriptions of the Dead Sea, recounting existing beliefs and traditions, was written by Richard Pococke (1704–1765), English clergyman and scientist, who toured the Holy Land in 1738 (Pococke,

1771). Filling a bottle of water from the lake, he found it to include only salt and a little alum. Forty years later, the results of a chemical analysis performed in Antoine Lavoisier's laboratory of the water sample brought by Pococke from the Dead Sea were published in France (Nissenbaum, 1970, 1986). This and various analyses done during the eighteenth and early nineteenth centuries, provided answers to another of the outstanding "curiositates": the buoyancy of the Dead Sea.

3. Early explorations

The first attempt to conduct research in and around the lake as an object of study in its own right should be attributed to the ill-fated exploration of Christopher Costigan (1810–1835), a young student of theology at Maynooth College, Ireland. He planned to sail along the Jordan into the Dead Sea, in an attempt to explore its shores, measure its depth, explain its buoyancy and understand other curious phenomena. In the summer of 1835 he transported a small boat purchased in Beirut from Acre to Tiberias, to be launched in the Sea of Galilee. His plan to sail along the Jordan failed, but after many adventures, Costigan succeeded in sailing on the Dead Sea for eight days. He barely survived the difficult voyage, only to die in Jerusalem a few days later. Costigan was buried in the Franciscan cemetery on Mount Zion without leaving even one document concerning his exploration, or any result of his scientific endeavors (Costello, 1974a, 1974b, 1978; Eriksen, 1985, 1986, 1989; Kreiger, 1988).

Contemporary travelers would have learned about Costigan's research objectives, travel adventures and death through the American lawyer, John Lloyd Stephens (1805–1852), later famous for his Mayan explorations (von Hagen, 1948). While visiting Palestine in 1836, the latter traced the ill-fated researcher's steps, found his boat in Jericho, interviewed his servant, the only witness to the voyage and, in his popular book published in 1837, told a major part of the story (figure 3) (Stephens, 1858; Goren, 1997). A second and complementary description was provided by the daughter of John Nicolayson (1803–1856), a Schleswig-Holstein-born Protestant missionary employed in Jerusalem by "The London Society for Promoting Christianity Amongst the Jews" (Gidney, 1908; Carmel, 1981; Cromby, 1991). Nicolayson, who after some difficulties succeeded in transporting the ailing Costigan from Jericho to Jerusalem, told the story to his daughter, who, several years later, presented it at a meeting of the Jerusalem Literary Society held on 12 February 1850 (Mastermann, 1905, 1911; Goren, 1997).

Costigan's failure to establish the level of the Dead Sea may not be surprising, and there seems to be no hint that he had any intention of taking hypsometrical measurements.

However, one might have expected the French officer, Camille-Antoine Callier (1804–1889), to have investigated this question. Commissioned by the French ministry of war to conduct as precise a study as he could of "the physical and descriptive geography of Asia Minor", as well as the topography of its different countries and regions, he traveled in the Orient for four years between 1830 and 1834 (Prevost and d'Amat, VII, 1956; Henze, I 1978; Bonato, 2003). In 1833, while traveling along the Jordan Rift Valley south towards the Dead Sea and then along the "Arabah valley to the head of

the Gulf of 'Akaba, Callier attempted to examine the theory that in ancient times the Jordan River connected the Dead and the Red Seas (Callier, 1834a, 1834b., 1840). He could only establish the existence of a significant valley, so he urged the need to study the entire Ghor Valley as well as the unexplored portion of the 'Arabah (Callier, 1838, 1839). He reached only the northwestern shore of the Dead Sea, so he was unable to give much attention to the lake itself. The Dead Sea is not mentioned in his formal report to the Parisian Geographical Society (Callier, 1834, 1840).

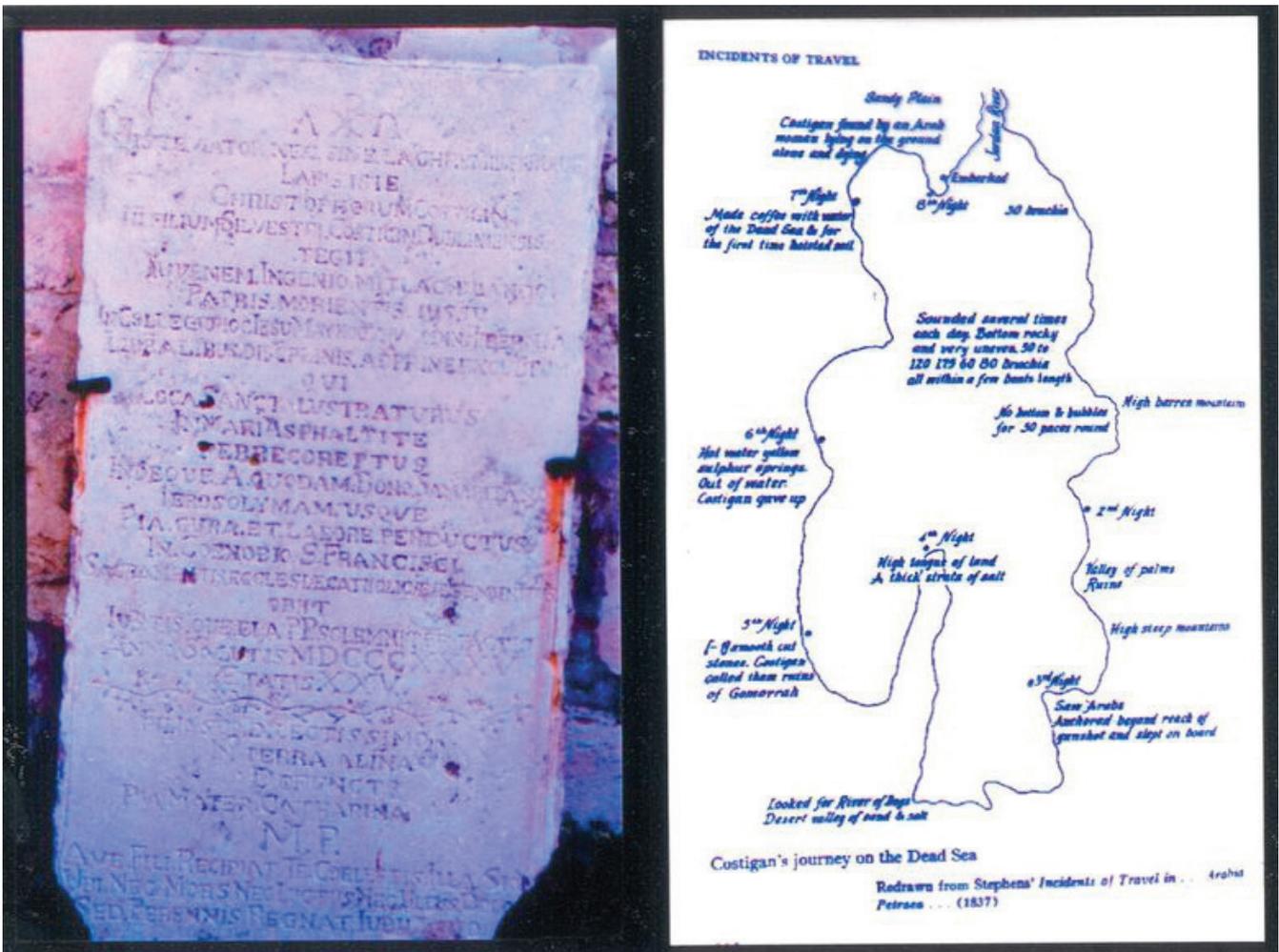


Figure 3: Costigan: Tombstone; Route by JL Stephens (Photograph in the Franciscan Museum, Jerusalem. Stephens 1858, II, p. 201)

4. "The Dead Sea is considerably lower than the Mediterranean"

It was not long, however, to register the first real advance in the study of the lake. In 1837, two teams, almost at the same time and without knowledge of each other, established the fact that the level of the Dead Sea is considerably lower than the Mediterranean. The first to publish the discovery was the

Journal of the Royal Geographical Society, reporting on a letter received from two English travellers, G. H. Moore and W. G. Beek. They found that "from several observations upon the temperature of boiling water", the surface level of the Dead Sea "appears to be considerably lower than the ocean" (figure 4) (Moore and Beek, 1837).

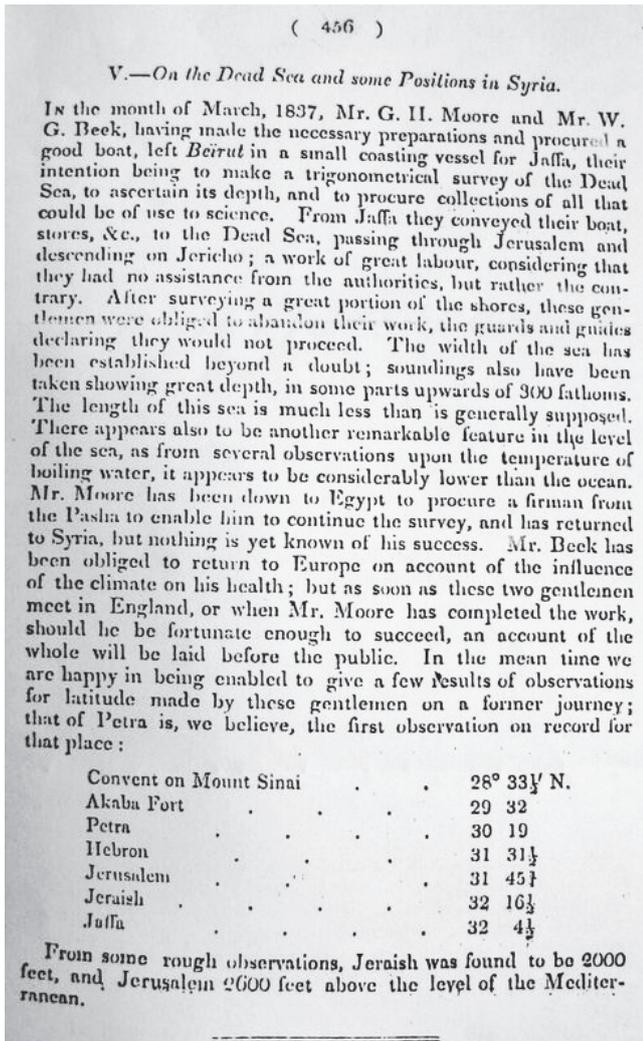


Figure 4: Moore and Beek's letter (Moore and Beek 1837. Journal of the Royal Geographical Society 7, p. 456)

George Henry Moore (1810–1870) was the son of a wealthy, noble Irish Catholic family that owned a large estate and Georgian mansion called "Moore Hall" on the shores of Laugh Carra, County Mayo in Western Ireland (figure 5). Moore began touring the Near East in mid-1834 without any prior intention of scientific study (Moore, 1913). But his two diaries that escaped destruction by his own hand in later years reveal intensive scientific activity in Syria and in and around the Dead Sea (figure 6) (Department of Manuscripts in the National Library of Ireland, MS 3509 – Dead Sea Diary; MS 3510 – Syrian Diary). Moore spent the winter of 1836/7 wandering among the villages in the Hauran, describing their antiquities and copying inscriptions (MS 3510). In Ba'albek he met up with an acquainted traveler, the English officer William George Beek (1804–1873) who, after serving in the Persian army and reaching the rank of colonel, continued travelling in the Near East. Thinking to sail back home they went to Beirut, where they changed their plans, purchased a small boat that they loaded

onto a local coastal vessel for transportation by sea to Jaffa, and then brought by land to Jerusalem to be launched in the Dead Sea. There they began measuring, collecting specimens, sailing and establishing depths, and the like. Security conditions and the refusal of their local guards and servants to proceed to the eastern and southern shores forced them to leave, and the only direct scientific result was their short letter published in the JRGS (MS 3509; Moore, 1913; Goren, 2011).



Figure 5: Moore Hall on Laugh Carra (Moore Hall, 2004, photograph by the author)

The similarity of Costigan's and Moore and Beek's surprising decisions to study the Dead Sea by boat, and that of their aims and methods, can hardly be coincidental. There must have been someone in Beirut who planted the idea of sailing in the heads of the young travelers. Following his voyage of 1806, the above-mentioned French novelist Chateaubriand wrote in his popular travel description that the lake would reveal interesting facts to one who launched a vessel in its waters (Chateaubriand, 1856; Kreger, 1988). A more likely candidate, however, was the American missionary Reverend John D. Paxton (1784–1868), who resided in Syria between 1836 and 1838. He frequently discussed Costigan's travel and consequently encouraged sailing on the lake for its study (Paxton, 1839).

The second team to set out in 1837 was Bavarian. Gotthilf Heinrich von Schubert (1780–1860) was already one of the leading natural history scientists in Germany, a distinguished scholar who combined the influences of Romanticism with the so-called German "Naturphilosophie" in his works. He embarked on his long pilgrimage-research voyage accompanied by two of his young students, who were in charge of the scientific work, and a painter. He declared that he was headed for "the lands of the beginning and the birth", to execute a "phisica sacra", a natural history geo-theological examination of the Holy Land (Schubert, 1838–9; Erdl, 1842; Goren, 1997b, 2003).

Schubert and his company reached Palestine from Egypt, following one of the accepted routes of the Exodus. They reached 'Akabah, and from the northern shore of the Red Sea continued northward through the 'Arabah and Hebron to Jerusalem. After spending time in Jerusalem, they left the city for Jericho, the baptismal site and the Dead Sea. Using a barometer, they also established that these locations are lower than the Mediterranean. Moore's diary reveals their encounters with well-known figures in Jerusalem, noting that "one of them was a great natural history professor. Consequently the whole party thought of nothing but natural history" (MS 3509). Schubert recalls the "somewhat extraordinary" sight of the new vessel flying the British flag, which they saw upon arriving at the Dead Sea, with nobody around it, as the British team spent that extremely hot day in their tent, some miles to the north. "We looked at the boat with profound empat", wrote the Bavarian scholar, "and were already happy then because of the future yield of scientific knowledge, which could justly be expected from this new, extraordinary sailing". He adds his regret for not being able to meet the "two interesting travelers", who could have been of great help to him (Schubert, 1839, 93). The Germans were the second to publish this astonishing fact, but the discussion between them and the English for the primacy of this revelation continued for some years.

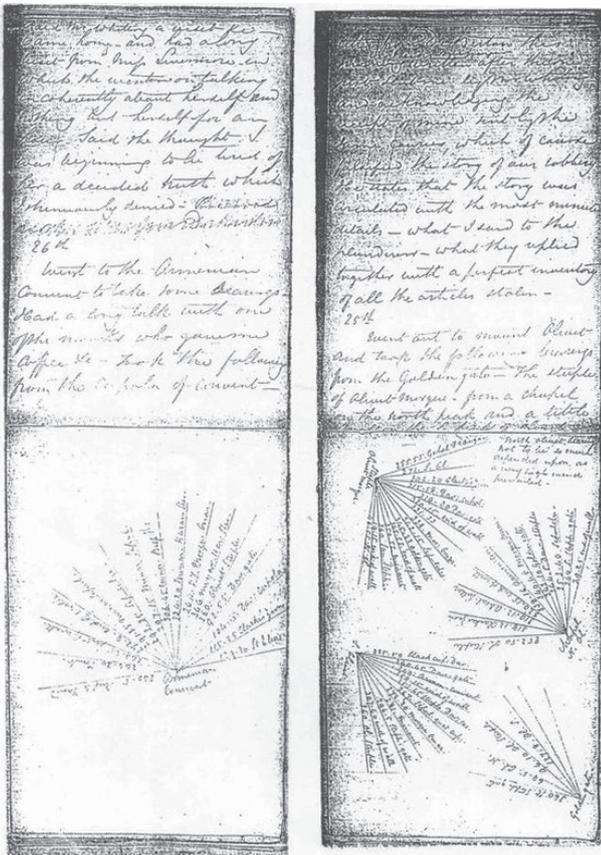


Figure 6: Dead Sea Diary (National Library of Ireland, MS 3509)

5. In Moore and Beek's footsteps

The French Count Jules de Bertou followed in his compatriot Callier's footsteps in many respects. From his base in Beirut, he was the first European in the new era to travel the entire length of Wady el 'Arabah, and to establish the location of the watershed between the Dead Sea and the Red Sea. Initially, he denounced Moore and Beek's claimed discovery, because it contradicted the accepted theory he was advocating, namely, the flow of the Jordan into the Gulf of 'Akaba. It took him some time to change his mind, and another year to follow their research (Callier, 1838, 1839; Berghaus, 1839). Bertou waited for the following spring, and then went to the Dead Sea and the 'Arabah Valley equipped with a barometer. His goal was to repeat the experiment conducted "by my friend, M. G. Moore" who, according to his claim, found that the water started boiling at a temperature of 216° or 217° Fahrenheit (=102.22° or 102.77° C), and to try and verify the results with his barometer. Upon completion of the experiment, he published his results concerning the basin of the Dead Sea, namely, that it is "much lower" than the Red Sea (Bertou, 1838a, 1838b, 1839a, 1839b, 1839c). The report in the JRGS in 1842 gave his result as 1332.46 feet; if he meant English (and not Parisian) feet – then the result is a level of -406.13m (Hamilton, 1842). There were other published versions, such as that of the German geographer Carl Ritter (1779–1859), who later summarized all the results and wrote that Bertou measured 1290 Parisian feet, equal to 419.25m (Ritter, 1850).

The American minister and scholar Edward Robinson (1764–1893) and his companion, the American Presbyterian missionary Eli Smith (1810–1857), met de Bertou in 1838 in Jerusalem. During that year, Robinson and Smith conducted their studies of the Biblical historical-geography and toponymy of the country, and their book, published in 1841, became a cornerstone of the study of the Holy Land (figure 7) (Robinson and Smith, 1841; cf. Ben-Arieh, 1979; Goren, 1999, 2003). Robinson, who did not perform the measurements by himself, became deeply involved in the study of the Dead Sea and the Jordan depression. Various factors, such as the poor relations between the Frenchman and his Bedouin guides, the use of a simple and illiterate interpreter and a disregard for accuracy, made Robinson extremely critical of Bertou's results and conclusions (Robinson, 1839; Robinson and Smith, 1841, II).

The Austrian montanist (mineralogist and geologist) Joseph Russegger (1802–1863) was invited in 1836 by Muhammed 'Ali to find exploitable minerals in the countries under his rule. In late autumn, he conducted his own barometrical measurements of the Dead Sea and the Jordan depression. He reported that the surface of the Dead Sea is 1319 Parisian feet (428.7 m) lower

than the Mediterranean, and 1349 feet lower than the Red Sea (Mahlmann, 1846; Russegger, 1840, 1841; Goren, 2003).

Sea (figure 8). What were his results? The first report in the JRGS of 1842 lists 1311.9 feet (probably Parisian, 426.4 m), and corresponds with the data on the sketch of the triangulation housed in the RGS Archive (Symonds, Rough Sketch of a portion of the Triangulation of the Southern District of Syria, 16th April 1842 [RGS Archive]; Hamilton, 1842; Robinson and Smith, 1841; Robinson, 1843).

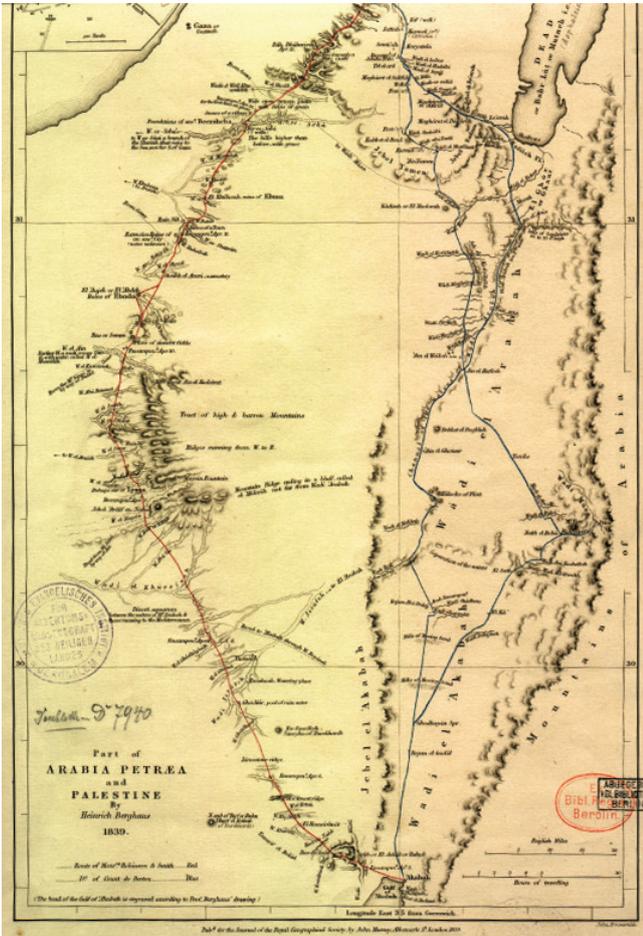


Figure 7: Berghaus, Map, routes of Robinson/Smith and Bertou in the Negev (Deutsche Evangelische Institut, Jerusalem, D 7940)

At the beginning of the 1840's, the exact level of the Dead Sea was still undetermined. It became clear that accuracy could not be achieved with a barometer, so researchers turned to hypsometrical measurement based upon the Mediterranean. Lieutenant John Frederick Anthony Symonds (?–1852) belonged to a group of English officers that accompanied the forces sent to Syria in the summer of 1840 as part of the effort to free the country from Muhammed 'Ali and restore Ottoman rule (Jones, 1973; Lambert, 2000). They surveyed some of the coastal cities and their fortifications, measured Jerusalem, and then began a general triangulation of the country. The survey started in May 1841, but was never completed (Alderson, 1843; Rochfort Scott, 1846; Jones, 1973). The survey of "southern Syria" had been Symonds' mission, and it included trigonometrical and hypsometrical measurements between the Mediterranean and the Sea of Galilee, and between the Mediterranean and the Dead

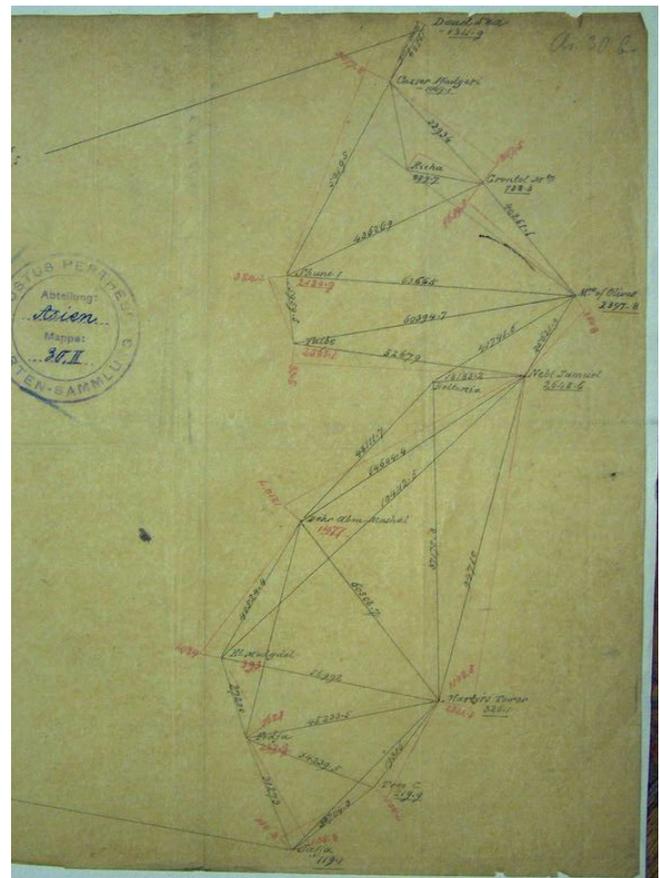


Figure 8: Symonds, Rough sketch of a portion of the triangulation of the Southern District of Syria (Universitäts- und Forschungsbibliothek Erfurt/Gotha, Sammlung Perthes, Kartensammlung, Asien, 30 II; RGS/IBG Archives, OBS. 155)

Symonds received the Gold Medal of the Royal Geographical Society for his achievements in Holy Land cartography, but the accuracy of his measurements was later questioned by his fellow officers as well as by other scholars (Jones, 1973). They began to suspect that Symonds had failed in determining the level of the Sea of Galilee. He claimed that its surface is only of 328.1 feet (106.6 m) lower than the Mediterranean, almost exactly half of the correct level. This failure led a disappointed Robinson to discredit all of Symond's measurements (Robinson, 1848; Kreiger, 1988).

6. The slope of the Jordan and Lynch's expedition

Indeed, it took eleven more years to solve two additional questions: the exact altitude of the lakes, and the course of the Jordan. This latter question seemed to be of a simple nature and easy to solve. Upon establishing the accurate altitudes of the Sea of Galilee and the Dead Sea and the exact distance between them, it should be easy to calculate the average slope of the river. Robinson reached the conclusion that, since there are no big waterfalls along the river, which also seems not to be of a meandering nature, the slope should be quite extraordinary:

Yet in the 984 feet of its descent in 60 geographical miles, there is room for three cataracts, each equal in height to Niagara, and still to leave to the river an average fall equal to the swiftest portion of the Rhine, including the cataract of Schaffhausen (Robinson, 1848).

A contemporary cartographer, the German August Heinrich Petermann (1822–1878) who worked in London, argued with Robinson, claiming that there is nothing special about the slope of the Jordan, which is equal to that of some of the most famous English Rivers (Petermann, 1848) (figure 9).

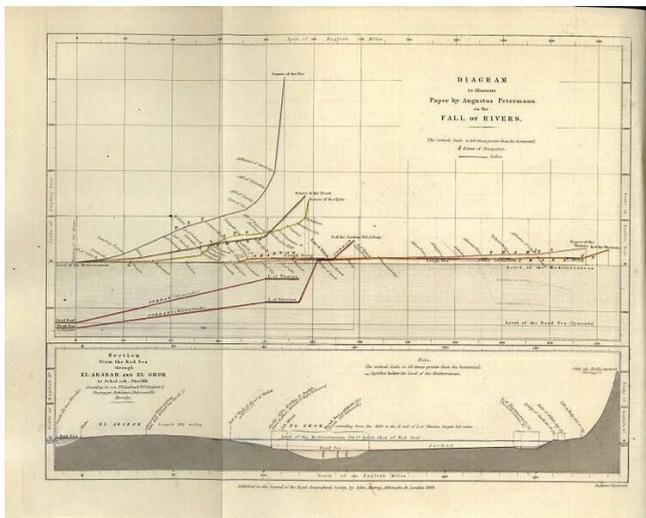


Figure 9: Petermann, Slope of the Jordan and some rivers in the UK (Diagram to Illustrate Paper by Augustus Petermann on the Fall of Rivers, Petermann 1838)

The mystery was solved in 1847 and published in the following year by the second victim of scientific exploration of the Dead Sea, the 24 year-old English navy lieutenant Thomas Howard Molyneux (1822–1847). Molyneux supplied the explanation for the slope of the Jordan by establishing its meandering nature. "Our objects", wrote Molyneux before dying from the aftereffects of his strenuous efforts in the face of dangerous security and weather conditions and salty water, "were to examine the course of the Jordan, as well as of the

valley through which it runs, and especially to measure the depth of the Dead Sea" (Molyneux, 1848). Molyneux found that the Jordan meanders to a great degree, so that there is no irregularity with its slope (figure 10).

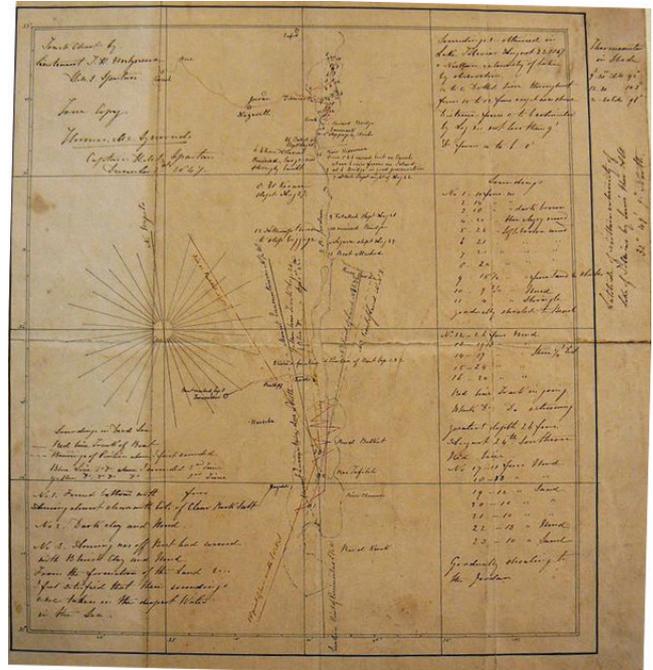


Figure 10: Molyneux, sketch-map, 1837 (Track Chart by Lieutenant T.H. Molyneux H.M.S. Spartan, Discrete Admiralty Library Manuscripts Vz7/40/2. Courtesy of Peter Collier)

That same year, 1848, saw the final phase of the long process to establish the exact level of the Dead Sea and to produce an accurate cartographic presentation. These were achieved by the most ambitious American expedition, led in 1848 by the above-mentioned American naval officer William Francis Lynch (Lynch, 1949; Montague, 1849; Lynch, 1952; cf. Ben-Arieh, 1973; Jampoler, 2005). Being a devoted Christian and an adventurer, it seems that Lynch's interest in the region derived from both characteristics. His study was highly scientific, exact and detailed, but his narrative is filled with descriptions of the feelings aroused by the river and the lake, as "[Facing a stormy wind] at times it seemed as if the dread almighty frowned upon our efforts to navigate a sea, the creation of his wrath" (Lynch, 1949, 269). In his summary, which he wrote at the end of his Official Report with much optimism and pride, Lynch added his strongest belief that "the exploration of this [the Dead Sea] was now complete". The Americans took exact soundings, determined geographical positions, drew topographical sketches of the shores, ascertained the temperature, width, depth, and velocity of the tributaries, collected specimens of water, minerals, plants and flowers, and noted weather and atmospheric phenomena (Lynch, 1852).

7. Summary

Lynch was by far too optimistic; much remained to be studied. However, the general exploration, the first stage in the scientific study of the Dead Sea and its surroundings, did reach its culmination with his expedition. The expedition researchers collected the primary facts and data, and sought and found answers to the traditional questions and curiosities of the Jordan depression and the lake.

There is probably no one more deserving and authorized to sum up the description of these eleven turbulent years in Dead Sea research, than the leading German geographer Carl Ritter, who was deeply involved in the scientific research of Palestine though he never visited the land (Goren, 1999). In 1850, he gave a lecture and published a booklet entitled *The Jordan and the Sailing on the Dead Sea*. Ritter presented a full summary of the history of the exploration, of the facts collected and the research accomplished to date:

Certainly those were so far only boats brought there from England and North America [...] These seafaring nations tried what was unheard before, to send some supplied missions to the Jordan and the Dead Sea, through the help of their governments, in order to bring to an end the up till now disgraceful disknowledge of many neighbouring European cultural people about the formation of that valley. They had no idea how difficult such a mission was. The energy applied to fulfilling this task was demonstrated by the three repetitive starts, that were needed to overcome the forces against them! (Ritter, 1850b, 17).

Who were the creators of "the drama of the scientific community's awareness of the depression of the Dead Sea"? Ritter had no doubt: "The reader's attention ought to be called particularly to the fact that it is to this [Moore and Beek's – H.G.] expedition that we owe the direct discovery of the depression of the Dead Sea" (Ritter, 1850a). Lynch, and others following him, started looking at the Dead Sea as an area that needs to be studied in every relevant scientific field. This attitude did not prevent later scholars, such as the French Louis Caignart Feliçien de Saucy (1807–1880), to claim that he found the ruins of Gomorrah and to cause a stormy argument among the scholars (Saulcy, 1852, 1854).

All of the early participants in this drama were strongly attached to the region's special biblical connection. Consequently, I maintain that the study of the Jordan and the Dead Sea, at least in its initial stages, was not merely a scientific study; it cannot be described as simply geographical, historical, botanical or geological. The research questions all derived from historic religious connections, Old Testament narratives and the

traditions and "curiositates" that developed through the ages, the combined result of these tales with the mysterious nature of the lake and its inaccessibility. It might even be possible to say that the entire body of research on the Dead Sea, up until the second half of the nineteenth century, had, as its central purpose, understanding and verifying its important role in the Scriptures. The study of the Jordan and the Dead Sea, at least in its first stages, formed a complicated and multifaceted scientific inquiry, "historical geography of science and religion", one of the best demonstrations of "the story of encounters between scientific claims and religious convictions," (Livingstone, 1994, 367–374). "The chase after the level", I have preferred to call it. The Jordan and the Dead Sea play a highly significant role in different narratives of the Scriptures. They have both developed meanings that go far beyond their geographical names, greatly overriding their actual sizes. Moore and Beek's discovery was the start of a revolutionary scientific process, which directly affected other fields, not the least of which is theology and Bible studies. It changed the accepted understanding of the Scriptures, their geography – and their agreement with the existing topography.

References

- Alderson, R. C., 1843. Notes on Acre and Some of the Coastal Defense in Syria (Papers on Subjects Connected with the Duties of the Corps of Royal Engineers, VI). John Weale. London.
- Bekenmeier, A. (Ed.), 1993. *Reisen nach Jerusalem: Das Heilige Land in Karten und Ansichten aus fünf Jahrhunderten*, Sammlung Loewenhardt. Dr. Ludwig Reichert. Wiesbaden.
- Ben-Arieh, Y., 1972a. The geographical exploration of the Holy Land. *PEFQS* 104, 81–92.
- Ben-Arieh, Y., 1972b. Pioneer scientific exploration in the Holy Land at the beginning of the nineteenth century. *Terrae Incognitae* 4, 95–110.
- Ben-Arieh, Y., 1973. William F. Lynch's expedition to the Dead Sea, 1847–48. Prologue: *The Journal of the National Archives* (Spring), 14–21.
- Ben-Arieh, Y., 1979. *The Rediscovery of the Holy Land in the Nineteenth Century*. Magnes and Israel Exploration Society, Jerusalem, and Wayne State University Press, Detroit.
- Ben-Arieh, Y., 1997. *Painting the Holy Land in the nineteenth century*. Yad Izhak Ben-Zvi. Jerusalem.

- Berghaus, H., 1839. Extract from a letter of Professor Berghaus. *Journal of the Royal Geographical Society* 9, 308–310.
- Bertou, J. De, 1838a. Extraits de deux lettres de M. le comte J. de Bertou, sur son voyage dans la Palestine. *Bulletin de la Société de Géographie, Deuxième Série* 10, 240–6.
- Bertou, J. de. 1838b. Voyage de l'extrémité sud de la Mer Morte à la pointe nord du golfe Elanitique. *Bulletin de la Société de Géographie* 10, 18–32.
- Bertou, J. de, 1839a. Extrait d'une autre lettre de M. Bertou, datée de Beyrouth, le 25 novembre 1838. *Bulletin de la Société de Géographie, Deuxième Série* 11, 166–169.
- Bertou, J. de, 1839b. Notes on a journey from Jerusalem to Hebron, the Dead Sea, El Ghór, and Wádi Arabah to Akabah, and back by Petra; in April, 1838. *Journal of the Royal Geographical Society* 9, 277–286.
- Bertou, J. de, 1839c. Itinéraire de la mer Morte à Akaba par les Wadys-el-Ghor, el-Araba et el-Akaba, et retour à Hébron par Petra. *Bulletin de la Société de Géographie, Deuxième Série* 11, 274–331.
- Bliss, F. J., 1907. *The Development of Palestine Exploration: Being the Ely Lectures for 1903*. Charles Scribner's Sons. New York.
- Boggis, J. E., 1939. *Down the Jordan in a Canoe*. Society for Promoting Christian Knowledge. London.
- Bonato, L., 2003. Camille Callier: un officier instruit de l'armée française qui explora Chypre en 1832. *Thetis* 10, 113–141.
- Callier, C., 1834a. Voyage en Asie Mineure, en Syrie, en Palestine et en Arabie-Pétrée. *Bulletin de la Société de Géographie de Paris* 7, 5–22, 239–262.
- Callier, C., 1834b. Reise des Stabskapitän's Callier von Jerusalem nach Akabah am rothen Meere. *Das Ausland* 7, 137–8, 546–8, 551–2.
- Callier, C., 1838. Note sur le voyage de M. le comte de Bertou, depuis le Lac Asphaltite jusqu'à la Mer Rouge, par le Ouadi-èl-Araba. *Bulletin de la Société de Géographie de Paris, Deuxième Série* 10, 84–100.
- Callier, C., 1839. Mémoire sur le dépression de la Mer Morte et de la vallée du Jourdain. *Nouvelles Annales des Voyages et des Sciences Géographiques* 21, 5–38.
- Callier, C., 1840. Carte de la Syrie Méridionale et de la Palestine, dressée en 1835, d'après les ordres du Directeur du Dépôt général de la guerre Lieutt Général Pelet. Paris. Carmel, A., 1981. *Christen als Pioniere im Heiligen Land: Ein Beitrag zur Geschichte der Pilgermission und des Wiederaufbaus Palästinas im 19. Jahrhundert*. Friedrich Reinhardt. Basel.
- Chateaubriand, F. R. de, 1856. *Itinéraire de Paris à Jérusalem, I–II*. Firmin-Didot. Paris.
- Costello, C., 1974a. Nineteenth-century Irish explorers in the Levant. *Irish Geography* 7, 88–96.
- Costello, C., 1974b. *Ireland and the Holy Land: an account of Irish links with the levant from the earliest times*. C. Goodfile Neale. Alcester and Dublin.
- Costello, C., 1978. Christopher Costigan, explorer of the Dead Sea. *Irish Geography* 11, 214.
- Crombie, K., 1991. *For the love of Zion: christian witness and the restoration of Israel*. Hodder & Stoughton. London, Sydney and Auckland.
- d'Anville, J. B. B., 1771. *Palestine*. London.
- de Vries, D., 1996. De kaart van Palestina door C. W. M. van de Velde (1858): een 'autoriteitsstuk', "Capita selecta" uit de geschiedenis van de kartografie. NVK publikatiereeks 18. Utrecht. pp. 15–26.
- Erdl, M. P., 1842. Barometer- u. Thermometer-Beobachtungen, angestellt auf einer Reise durch Arabia Peträa, Palästina und Syrien. *Annalen der Erd-, Völker und Staatenkunde* 1, 267–280.
- Eriksen, E. O., 1985. Christopher Costigan (1810–1835): Irish explorer of the Dead Sea. *Holy Land*, 41–49.
- Eriksen, E. O., 1986. The Illness of Christopher Costigan – A case of heat stroke. *Dublin Historical Record* 39, 82–85.
- Eriksen, E. O., 1989. *Holy Land Explorers*. Franciscan Printing Press, Jerusalem.
- Fischer, H., 1939/40. Geschichte der Kartographie von Palästina. *ZDPV* 62, 169–189; 63, 1–111 (Bd. II, 43–5).
- Gidney, W. T., 1908. *The History of the London Society for Promoting Christianity Amongst the Jews, from 1809 to 1908*. London Society for Promoting Christianity Amongst the Jews. London.
- Godlewska, A. M. C., 1999. *Geography unbound: French geographical science from Cassini to Humboldt*. University of Chicago Press, Chicago.

- Gollwitzer, H., 1948. Deutsche Palästinafahrten des 19. Jahrhunderts als Glaubens- und Bildungserlebnis. Bischoff, B., Stammeler, W., (Eds.), *Lebenskräfte in der Abendländischen Geistesgeschichte: Festschrift für Walter Goetz zum 80. Geburtstag*, Simons. Marburg. 286–324.
- Goren, H., 1997a. Nicolayson and Finn describe the expeditions and deaths of Costigan and Molyneux. *Cathedra* 85, 65–94 [Hebrew and English].
- Goren, H., 1997b. Johannes Rudolph Roth: Ein Leben für die Palästinaforschung. *Jahrbuch der Deutschen Evangelischen Instituts für Altertumswissenschaft des Heiligen Landes* 5, 22–44.
- Goren, H., 1998. The chase after the Bible: individuals and institutions – and the study of the Holy Land, Ute Wardenga, U., Wilczyński, W. J., (Eds.). *Religion, Ideology and Geographical Thought (WSP Kielce Studies in Geography, 3)*, Wydawnictwo JENOSĆ. Kielce. pp. 103–115.
- Goren, H., 1999. Carl Ritter's contribution to Holy Land research. Buttner, A., Brunn, S. D., Wardenga U., (Eds.), *Text and Image: Social Construction of Regional Knowledge*. Institut für Länderkunde. Leipzig. pp. 28–37.
- Goren, H., 2003. "Zieht hin und erforscht das Land": Die deutsche Palästinaforschung im 19. Jahrhundert (trsl. Naujoks, A.C., Schriftenreihe des Instituts für deutsche Geschichte der Univesität Tel Aviv, 23). Wallstein, Göttingen.
- Goren, H., 2004. How low is the lower point on earth? The story of determining the level of the Dead Sea. Maos, J. D., Inbar, M., Shmueli, D. F., (Eds.), *Contemporary Israeli Geography (Horizons in Geography, 60–1)*. Department of Geography and Environmental Studies, University of Haifa. Haifa. pp. 147–162.
- Goren, H., 2008. Chasing the Level: how was the level of the Dead Sea established? *R.I.M.S. News*, Report 34, 3–7.
- Goren, H., 2009. The Excursion to Establish the Level of the Dead Sea. *Galileo* 129. 26–35 [Hebrew].
- Goren, H., 2011. *Dead Sea Level: Science, Exploration and Imperial Interests in the Near East (Tauris Historical Geography Series 6)*. I.B. Tauris. London.
- Goren H., Schelhaas, B., 2015. Colonial, religious and scientific mapping. The cartographic practice of Charles William Meredith van de Velde. García-Álvarez, J., Carlos Garcia, J., (Eds.). *History of Geography and Colonialism*, Centro de Estudos Geográficos. Lisbon. pp. 207–223.
- Hamilton, W. R., 1842. Address to the Royal Geographical Society of London. *Journal of the Royal Geographic Society* 12. xxxv–lxxxix.
- Henze, D., 1978. *Enzyklopädie der Entdecker und Erforscher der Erde, I*, Akademische Druck - u. Verlagsanstalt. Graz.
- Jampoler, A. C. A., 2005. *Sailors in the Holy Land: The 1848 American Expedition to the Dead Sea and the Search for Sodom and Gomorrah*. Naval Institute. Annapolis.
- Jones, Y., 1973. British Military Surveys of Palestine and Syria 1840–1841. *The Cartographic Journal* 10/1, 29–41.
- Kreiger, B., 1988. *Living waters: myth, history and politics of the Dead Sea*. Continuum. New York.
- Lambert, A., 2000. "Within Cannon Shot of Deep Water": The Syrian Campaign of 1840. Hore, P., (Ed.), *Seapower Ashore: 200 Years of Royal Navy Operations on Land*. Chatham. London. 79–95.
- Laor, E., Klein, S., 1986. *Maps of the Holy Land: Cartobibliography of printed maps, 1475–1900*. Alan R., Liss. New York, Meridian Publishing, Amsterdam.
- Lindenau, B., von, 1810. Über bey diesem Heft befindliche Karte von Palästina. *Monatliche Correspondenz zur Beförderung der Erd- und Himmels-Kunde* 22, 542–551.
- Livingstone, D. N., 1994. Science and religion: foreword to the historical geography of an encounter. *Journal of the Royal Geographical Society* 20 (4), 367–383.
- Lynch, W. F., 1849. *Narrative of the United States' Expedition to the River Jordan and the Dead Sea*. Philadelphia.
- Lynch, W. F., 1852. *Official report of the United States' expedition to explore the Dead Sea and the River Jordan*. John Murphy. Baltimore.
- Mahlmann, W., 1836. Von dem K. K. Vicedirector der Berg- und Salinen-Direction von Tirol und Vorarlberg Hrn. Russegger *Bemerkungen über dessen meteorologische Hauptdurchnitte und die barometrische Höhenbestimmung des Todten Meeres, datirt Hall in Tirol, am 4. September 1845*. Monatsberichte über die Verhandlungen der Gesellschaft für Erdkunde zu Berlin, N.F. 3, 163–167.
- Masterman, E. W. G., 1905. Explorations in the Dead Sea Valley. *The Biblical World*, New Series 25, 407–421.
- Masterman, E. W. G., 1911. Three early explorers in the Dead Sea Valley: Costigan – Molyneux – Lynch. *Palestine Exploration Fund, Quarterly Statement* 43, 13–19.

- Molyneux, T. H., 1848. Expedition to the Jordan and the Dead Sea. *Journal of the Royal Geographical Society* 18, 104–130.
- Montague, E., 1849. Narrative of the late expedition to the Dead Sea, from a diary by one of the party. Carey and Hart. Philadelphia.
- Moore, G. H., Beek, W. G., 1837. On the Dead Sea and some Positions in Syria. *Journal of the Royal Geographical Society* 7, 456.
- Moore, M. G., 1913. An Irish gentleman George Henry Moore: his travel, his racing, his politics., T. Werner Laurie. London.
- Nissenbaum, A., 1970. Chemical analyses of Dead Sea and Jordan River water, 1778–1830. *Israel Journal of Chemistry* 8, 281–287.
- Nissenbaum, A., 1986. Chemical analyses of Dead Sea water in the 18th century. *Journal of Chemical Education* 63, 297–299.
- Paxton, J. D., 1839. Letters from Palestine written during a residence there in the years 1836, 7, and 8. Charles Tilt. London.
- Perrin, N., 1988. Forward. Kreiger, B., (Ed.), *Living Waters: Myth, History, and Politics of the Dead Sea*. New York. pp. 8–11.
- Perthus, S., Faehndrich, J., 2013. Visualizing the map-making process: studying 19th century Holy Land cartography with MapAnalyst. *e-Perimetro* 8 (2), 60–84.
- Petermann, A., 1848. On the fall of the Jordan, and of the principal rivers in the United Kingdom. *Journal of the Royal Geographical Society* 18, 89–104.
- Pococke, R., 1771. *Beschreibung des Morgenlandes und einiger andern Länder I–II*. Walther. Erlangen.
- Prevost, M., d'Amat, R., (Eds.) 1956. *Dictionnaire de Biographie Française, VII. Letouzey et Ané*. Paris.
- Ritter, C., 1850a. Die Erdkunde von Asien, VIII/2: Die Sinai-Halbinsel, Palästina und Syrien, II/1: Palästina und Syrien. G. Reimer. Berlin.
- Ritter, C., 1850b. Der Jordan und die Beschiffung des Todten Meeres. G. Reimer. Berlin.
- Robinson, E., 1839. Bemerkungen über Herrn v. Bertou's Bericht von seiner Reise durch Wady el-'Arabah vom todten Meere nach 'Akabah im Jahre 1838. *Monatsberichte über die Verhandlungen der Gesellschaft für Erdkunde zu Berlin* 1, 192–203.
- Robinson, E., 1843. Depression of the Dead Sea, etc. *Bibliotheca sacra* 1, 15–17, 556.
- Robinson, E., 1848. Depression of the Dead Sea and of the Jordan Valley. *Journal of the Royal Geographic Society* 18 (II), 77–88.
- Robinson E., Smith, E., 1841. *Biblical Researches in Palestine, Mount Sinai and Arabia Peträa: A Journal of Travels in the Year 1838* 3 vols. J. Murray. London.
- Rochfort Scott, R., 1846. Map of Syria, constructed from the surveys and sketches of the officers mentioned below in that country in 1840 1841, by Major R. Staff-Corps, under whose general direction the work was undertaken, Major F. H. Robe, 87th Fusileers and R. Wilbraham, 7th Fusileers, and Lieut. J. F. A. Symonds R. Engineers. London 1846.
- Russegger, J., 1840. Chronologische Übersicht meiner Reisen in den Jahren 1835 bis 1840. *Monatsberichte über die Verhandlungen der Gesellschaft für Erdkunde zu Berlin* 2 (3), 61–73.
- Russegger, J., 1841. Ueber die Depression des todten Meers und des ganzen Jordan-Thals, vom See Tiberia bis zum Waddi el Chor. *Annalen der Physik und Chemie* (Ed. J. C., Poggendorff) 53, 179–194.
- Said, E. W., 1978. *Orientalism*. Kegan Paul. London and Henley.
- Saulcy, L. F. C. de, 1852. *Esquisse du littoral de la Mer Morte et de la Moabitude d'après la carte inédite, levée en 1851*. Paris.
- Saulcy, F. de, 1854. *Narrative of a Journey Round the Dead Sea and in the Bible Lands in 1850 and 1851: Including an Account of the Discovery of the Sites of Sodom and Gomorrah*, Ed. E. de Warren, I–II, R., Bentley. London.
- Schäbler, B., 1995. Ulrich Jasper Seetzen (1767–1811), Jeveraner Patriot, aufgeklärter Kosmopolit und Orientreisender. Ulrich Jasper Seetzen (1767–1811) *Leben und Werk: Die arabischen Länder und die Nahostforschung im napoleonischen Zeitalter* (Vorträge des Kolloquiums vom 23. und 24. September 1994, Veröffentlichungen der Forschungs- und Landesbibliothek Gotha, 33). Forschungs- und Landesbibliothek, Gotha. pp. 113–134.
- Schienerl, J., 2000. *Der Weg in den Orient: Der Forscher Ulrich Jasper Seetzen: Von Jever in den Jemen (1802–1811). Isensee*. Oldenburg.
- Schubert, G. H. von, 1838–1839. *Reise in das Morgenland in den Jahren 1836 und 1837*, 3 vols. Palm & Enke. Erlangen.

- Seetzen, U. J., 1810. *Charte von Palästina reducirt aus den von dem Herrn D. Seetzen an Ort und Stelle entworfenen Handzeichnungen*, Gotha.
- Shaw, T., 1757. *Travels, or observations relating to several parts of Barbary and the Levant*. Millar and Sandby. London.
- Stephens, J. L., 1858. *Incidents of a travel in Egypt, Arabia Petraea and the Holy Land, by an American*, I–II. Derby & Jackson, New York (1st ed. 1837).
- Tishbi, A., 2001. Jacob Ziegler. *idem* (Ed.), *Holy Land in Maps*. The Israel Museum. Jerusalem, pp. 86–87.
- Van de Velde, C. W. M., 1854. *Narrative of a journey through Syria and Palestine in 1851 and 1852*, I–II. William Blackwood. Edinburgh and London.
- Van de Velde, C. W. M., 1858a. *Map of the Holy Land 1:315,000*. Justus Perthes. Gotha.
- Van de Velde, C. W. M., 1858b. *Memoir to Accompany the Map of the Holy Land*. Justus Perthes. Gotha.
- von Hagen, V. W., 1948. *Maya Explorer: John Lloyd Stephens and the Lost Cities of Central America and Yucatan*. University of Oklahoma Press. Norman, OK.
- Werblowsky, R. J. Z., 1983. *The meaning of Jerusalem to Jews, Christians and Muslims*. Israel Universities Study Group for Middle Eastern Affairs. Jerusalem.
- Wright, J. K., 1966. *Notes on early American geopiety*. *idem* (Ed.), *Human Nature in Geography*. Harvard University Press. Cambridge, MA. pp. 250–285.