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The false Basel earthquake of May 12, 1021

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Abstract The Basel (CH) area is a place with an increased seismic hazard. Consequently, it is essential to scrutinize a famous statement by Stumpf (Gemeiner loblicher Eydgnoschafft Stetten, Landen und Völckeren Chronikwirdiger thaaten beschreybung. Durch Johann Stumpffen beschriben, 1548) that allegedly a large earthquake took place in Basel in 1021. This can be disproved unambiguously by applying historical and philosophical methods.

Keywords Macroseismic · Middle Ages · Basel · False earthquake · Historical seismology · Critical assessment of sources

1 Introduction

The Basel area in the Upper Rhinegraben is one of the places in Central Europe with increased seismic hazard. It is recorded that on October 18, 1356, an earthquake seriously damaged the city and region of Basel. According to numerous documentary sources and archaeological and seismological findings, its maximum macroseismic intensity is estimated at intensity IX according to EMS-98 scale and the

epicenter located a few kilometers to the south of Basel (Fäh et al. 2007). Nowadays, an event of this size would cause estimated damage of up to 50 billion euros for Switzerland only (Schmid and Schraft 2000). In subsequent centuries, major seismic events occurred in the years 1357, 1428, 1572, 1610, 1650, and 1682, all reaching an intensity of VII. Since then, only minor earthquakes occurred (ECOS 2002 and Fäh et al. 2003). Earthquakes in prehistoric times might have caused several earthquake-induced structures, revealed by paleo-seismological investigations of lake deposits in the Basel area (Becker et al. 2002). Based on observations of two lakes, five events were detected. Three of them are most probably related to earthquakes that occurred between 180–1160 BC, 8260–9040 BC, and 10720–11200 BC, respectively. The effects of the 1356 earthquake, however, were not visible in the lake deposits either due to unfavorable conditions in lake sedimentation during that time or because human activity in the following centuries destroyed the geological archive. Therefore, no findings are to be expected from such paleo-seismological investigations for the centuries before 1356. Because written records for the first millennium AD are very scarce (Gisler et al. 2007), the situation is even more aggravated. A supposed earthquake of AD 250 in Augusta Raurica, a former Roman city near Basel, presently called Augst, depends mostly upon archeological evidence (Fäh et al. 2006). As there are neither paleo-seismological traces of this event nor the expected traces of a strong site effect, it

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was assigned a magnitude M_w of about 6.0 or even lower, with a source location very close to the city. Another big earthquake in the year 849 was analyzed by Gisler et al. (2007).

The earthquake with an estimated intensity of V as observed in Bavaria in 1021 was often related to allegedly extensive damage in the city of Basel, thus drawing a parallel with the 1356 earthquake (Giardini et al. 2004). This alleged tremor was first mentioned in the sixteenth century, and in the earthquake catalogs, it is assigned intensity IX, as in Rothé and Schneider (1969), Van Gils and Leydecker (1991), or in MECOS 99 (1999). The existence of such an event would reduce the estimated recurrence time for large events in Basel, and we would have to expect an impact on the seismic hazard estimates. Although it was still used for the first generation of seismic hazard maps for Switzerland (Sägesser and Mayer-Rosa 1977), it is no longer included in the recent seismic hazard evaluation of 2004 (Giardini et al. 2004). In fact, as no original source was ever found, Alexandre (1990) no longer accepted that the Bavaria 1021 event was felt in Basel, and he listed it in his “Catalogue des faux séismes” (1990, 193). However, it would be a post hoc fallacy to deduce a non-occurrence on the basis of insufficient information. It is therefore imperative to analyze all compiled reports from the sixteenth century about the alleged earthquake before excluding the existence of a lost source.

2 The Bavarian event of 1021

An original source from the Benedictine monastery of St. Gallen (CH) and several copies of a lost source from the Benedictine monastery at Hildesheim (D) enable an assessment of the 1021 event (Alexandre 1990, 139). The *Annales Hildesheimenses minores* (1878) mentioned with the brevity typical of the Early and partly also of the High Middle Ages: “1021. Ingens terre motus in Baioariae partibus 4. Id. Maii, hora 10. diei, feria 6. post ascensionem Domini contigit” [A huge earthquake occurred in Bavaria on May 12, 1021, at the tenth hour of the day, on Friday after Ascension Day]. The more elaborate and versified description from the *Annales Sangallenses Miores* (1826): “1021(1027) Hic quatitur totus terrae globus undique motus, Horrida ceu fassis portenta sonant in abyssis” [Here (probably in St. Gallen) the

whole globe is concussed from everywhere through a motion, as if monsters roared in the abysses]. Therefore, with two rather consistent pieces of data and two localizations, it can be assumed with a certain degree of probability that an earthquake occurred in the region of Bavaria and Eastern Switzerland on May 12, 1021, without any hint of possible damage in this region, and least of all in Basel. According to the EMS-98, an intensity V has to be assigned because the earthquake was felt in a considerable way, and the St. Gallen source, although more detailed, does not mention any damage. Although the occurrence of damage cannot be completely ruled out, to minimize the error rate, only explicitly mentioned damage can be used in an assessment. It is not possible to interpret terms such as “huge,” “prodigious,” or “horrible” (Fig. 1).

3 The Basel Cathedral: A humanistic misinterpretation

In the sixteenth century, Humanism sparked a new interest in the history of the Basel cathedral. A few scanty sources mentioned donations made to the cathedral by Henry II (973 or 978–1024), ruler of the Roman Empire, which included Basel at that time, as well as probable building activities at the beginning of the eleventh century and the date of an inauguration of the cathedral in 1019. Several humanists presented three hypotheses in an effort to explain the reasons for the building activities and the inauguration: namely, war damage inflicted by Hungarian attacks in the tenth century, erosion caused by the Rhine or an earthquake. This is how it was mentioned in Rhenanus (1531) and still referred to as a hypothesis, as well as in Mutius (1539). Finally, there is the *Chronicon Suevicum universale* (1881) dating from the eleventh century, a chronicle by Hermann of Reichenau, printed by Sichert (1529), one of the first historical works that mentioned the precise date of the 1021 earthquake without referring to the Bavarian localization.

All this information appeared again in Johannes Stumpf’s widespread chronicle (printed in 1548) in three passages referring to the years 1019 and 1021, interpreted and supplemented by a citation of an earthquake report by Felicitas Fabri (1438–1502) of 1488, printed in 1604. Fabri, however, explicitly described the Basel event of 1356 basing his report

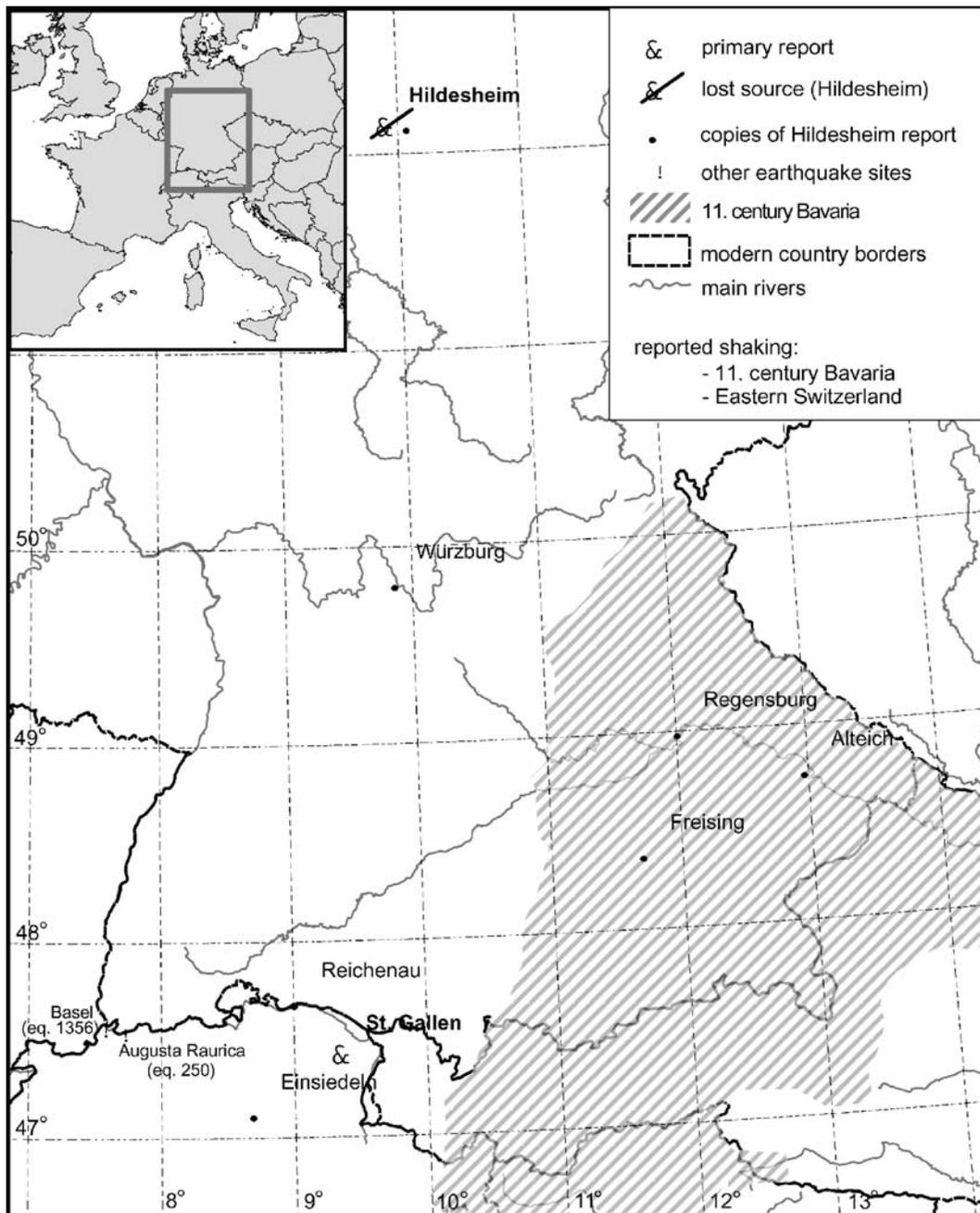


Fig. 1 Original source and copies of the Bavarian earthquake 1021; the 1356 Basel event and the alleged Augusta Raurica AD 250 event. *Reported shaking:* Original source from St. Gallen, the *Annales Sangallenses Maiores* (1826); lost source of Hildesheim and borders of Bavaria at the beginning of the eleventh century (Putzger 1954, 46). *Copies* The lost *Annales Hildesheimenses maiores* copied in *Annales Hildesheimenses minores* (1878) (Hildesheim), *Annales Altahenses*

(1891) (*minores*) (Niederalteich, near Passau), *Chronicon Suevicum universale* (1881) (Hermann of Reichenau), *Annales Einsidlenses* (1839) (Einsiedeln), *Annales Wirziburgenses* (1829) (Würzburg) and perhaps copied in *Annales S. Stephani Frisingenses* (1881) (Freising). The *Annales Ratisponenses* (1861) (Regensburg) could well be a copy of a lost source. Epicenter of the 1356 Basel event. The alleged AD 250 Augusta Raurica event

on the chronicle by Heinrich of Diessenhofen (ca. 1300–1376), printed in 1868. Stumpf transferred to the annals of 1021 parts of the texts that referred to 1019, and created: “A frightening earthquake occurred in 1021, on Friday, May 12, destroying the cathedral of Basel in such a way that some of its buildings fell into the river Rhine since they were built near the water. However, (the emperor) Henry II renovated the cathedral of Basel at great expense, relocating it 14 footsteps away from the bank of the Rhine” (Stumpf 1548, chapter 21, 47a).

Already the date of the inauguration, 1019, as given in Stumpf’s chapter “Von den Rauracern” (Stumpf 1548, 391), should draw attention to the wrong chronology. It would have meant a second rebuilding after 1021 of which, however, neither documented proof nor archaeological traces exist. For chronological, philological, and interpretative arguments, the detailed Early High German text can, by no means, be taken out of annals of the High Middle Ages. It is, on the contrary, a typical example of an early uncritical historiography and became the starting point for a peregrination through a lot of earthquake compilations, right up to the end of the twentieth century.

4 Conclusions

It has been proven that the alleged Basel earthquake of 1021 is an imaginative by-product of errors in the humanistic interpretation of sources concerning the Basel cathedral at the beginning of the eleventh century.

In the Basel area, only a few earthquakes are known for the time period before the big Basel earthquake of 1356. These include the Augusta Raurica earthquake in 250 (Schatzmann 2006; Fäh et al. 2006), which still remains questionable, as well as those events that can be inferred from paleo-seismological investigations. An event in the year 849 might be located in the Upper Rhinegraben area (Gisler et al. 2007). A more precise location, however, is presently not possible. They provide the basic input for the regional seismic hazard assessment, together with the series of events that occurred in the wake of the 1356 earthquake up to the present time. The list of events can be accessed through the website of the Swiss Seismological Service (<http://www.seismo.ethz.ch>). From the combined assessment of historical and paleo-seismological

information, an epicenter location in the wider Basel region cannot be ruled out. For the Basel area, it can be inferred that earthquakes of a magnitude comparable to the one in AD 1356 have occurred at least several times within the last 12000 years, and that the recurrence time for such important earthquakes is within the range of 1500–3000 years.

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