The 1834 Ermellek earthquake effects and the architecture of migration after war in Baroque times

Maria BOSTENARU DAN

Context

Sathmar Swabians migrated from SW Germany to Sathmar in Romania, along the Danube. Migration happened in the 18th century, starting 1712. In SW Germany that time Baroque churches started to be built. Also in Sathmar they built Baroque churches.

My grandfather was a Sathmar Swabian, hence genealogy research and personal communication with friends and relatives was combined with architectural history and earthquake engineering and geography research.

Research questions

The first aim of the research was to compare church architecture and vernacular architecture of Sathmar Swabians in their origin places with the places they colonised. It was observed, that the churches, although Baroque, are different, and that the vernacular architecture is also different. While in case of churches this may be influenced by foreign architects, in case of vernacular architecture it may be influenced by the fact that original architecture is not kept, as it was destroyed by the 1834 earthquake, and afterwards construction followed the rules from Vienna for migrants which came later to Banat.

Methodology

Overall methods

- Literature research
- Field investigation (site visits, discussions with inhabitants and site administrators)
- Archive research in genealogy archives
- Mapping
- Network analysis
- Comparative architecture investigation

Methodology – macroelements (1) churches and vernacular

- Structural mechanics: element – building – zone
  - Buildings subdivided in elements
  - Simplified calculations (Pavia): height plus material for common buildings
- Rural zone as application after urban zone Magheru in postdoc - Érmellék
  - Macroelements to determine seismic intensity at churches – engineering methods applied at cultural heritage reports (history – based on art history reports from archives, not buildings survey)
  - Conclusions from statistic mapping of damages in localities regarding seismic intensity – seismologic computations

Methodology – macroelements (2) churches

- ARC GIS lessons on buffer zones
- A free resource on the macro-elements method of Sergio Lagomarsino is available here http://db.nzsee.org.nz/Seminars/2014/Lagomarsino_Christchurch_2014-2-18.pdf including 28 COLLAPSE MECHANISMS OF THE SURVEY FORM FOR DAMAGE AND VULNERABILITY ASSESSMENT OF CHURCHES published in Lagomarsino S. (2012). Bull Earthquake Eng (2012) 10:73-92. Towers particularly considered. – to be applied
- (Lagomarsino and Podestà, Earthquake Spectra, May 2004 explains also a vulnerability index for all 28 mechanisms
- This needs to be updated for successive earthquakes

Methodology – macroelements (3) churches

- Literature
  - Lagomarsino S., Podestà S. (2004) Seismic vulnerability of ancient churches. Part 1: damage assessment and emergency planning. Earthquake Spectra. 20: 377-394
  - Lagomarsino S., Podestà S. (2004) Seismic vulnerability of ancient churches. Part 2: statistical analysis of surveyed data and methods for risk analysis. Earthquake Spectra. 20: 395-412
  - Lagomarsino, S. On the vulnerability assessment of monumental buildings. Bull Earthquake Eng 4, 445–463 (2006). https://doi.org/10.1007/s10518-006-9025-y
  - Application to churches: https://journals.sagepub.com/doi/abs/10.1193/1.1737735

Methodology – mapping churches and vernacular

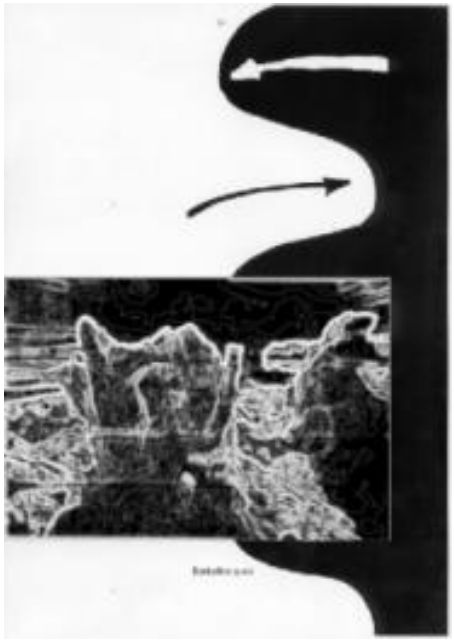
- ARC GIS lessons on buffer zones
- Relationship between scales:
  - Mapping common buildings versus landmarks
    - Lynch
    - Nolli
    - Muratori and Caniggia
    - Space syntax
  - Christopher Alexander: Pattern language
- Layer superposition: building – zone (different scales) graphically
  - Layer of common buildings (colour)
  - Layer of routes / strategical elements (plan)
- Applicable for tourist trails (see nature in the area)

Methodology – morphogenesis churches

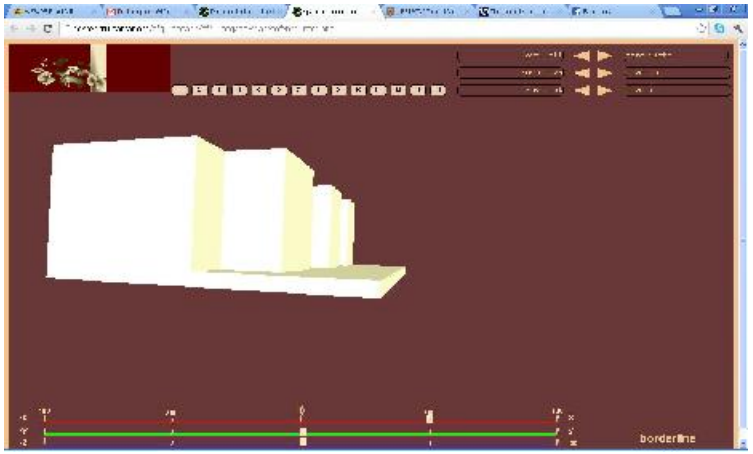
- The method of Lagomarsino models churches as summ of macro-elements.
- I worked with simplified models of churches in order to 3D model them for digital models.
- This is applicable when doing for example tours on maps, as in the mentioned mapping methods.
- But morphogenesis, in urban morphology, can be translated in structural morphology. Good methods of computational morphology for structures are developed by Ohmori (see IASS symposium 2005 in Bucharest). The Extended Structural Optimisation (ESO) method is available from here https://ecommons.cornell.edu/bitstream/handle/1813/11550/P6_Ohmori_Extended.pdf

Morphogenesis of simple shapes (1) – rediscovered space

2D



3D



Morphogenesis of simple shapes (1) – Lisbon earthquake

Simplified shape

Artistic drawing

Morphogenesis of simple shapes

- Simple shapes development https://arhitectura-1906.ro/2012/07/marcel-iancu-si-alfabetul-sau-formal-un-exercitiu-didactic-in-derulare-i/
- And the map at the basis of that http://www.e-cart.ro/asociatia/ro/noutati/Traseu_urban_M.Iancu.pdf
- Working with the 1755 Lisbon earthquake (previous slide) which is from a similar time as the historic ones regarded here

Methodology – game simulation

- Game simulation
  - City building games
  - Green revolution game
- Story maps with the landmarks can be done on ArcGIS
  - This is a participatory mean discussed at the EGU
- Story maps can incorporate those models maybe
- But maps can be done as games as in the Lisbon/Köln developments of the author with Adobe Director (3D or not)

Methodology – lessons between scales (church and vernacular)

- Lessons can be learned between
  - Urban morphology and resilience
    - Considering the street grid, incl. Deleuze's philosophy on flat and striated
  - Structural morphology and resilience
    - Considering that common buildings have grid structures but landmarks not

Methodology – lessons between scales (church and vernacular)

- an urban planning method which started with innovative approaches to urban maps (so to geography in which field the postdoc was) in the 1960s ("image of the city" by Lynch, derivé and psychogeography, and for Venice Caniggia and Muratori). Caniggia and Muratori followed somehow an Italian tradition started in the 17th century by Nolli with the plan for the city of Rome.
  - Between scales Bostenaru Dan, M. and Armas, I.: Earthquake impact on settlements: the role of urban and structural morphology, Nat. Hazards Earth Syst. Sci., 15, 2283–2297, https://doi.org/10.5194/nhess-15-2283-2015 , 2015 (here for Magheru boulevard, and this research adapts to Sathmar county area)

Methodology - tools

- Tools of humanities in the following slides

- All methods which do not have results so far, are to be applied in future research

Methodology – digital humanties (1)

- Historical photography and cartography integrated
  - Apart of historical photography reference on the map 3D models
  - Metadata of 3D models, ex. The vernacular house (semantics: taxonomy and ontology)
- http://digital-collections.online/ressourcen/tools/

- Building on early photography research already done when employed (ex. of maps in Adobe Director)
- See also other historical photography databases (also at Getty)

- Between architecture and historic photography for art history

Methodology – digital humanities (2)

- See also the paper on street network with Alex Dill
  - Space syntax to analyse the plan
- Classification of typologies through an ontology
- „Image of the city“ to analyse an image (see tools of image annotation on the next slide) ex. Disaster images
- Maps
  - Kevin Lynch
  - Psychogeography
  - Caniggia and Muratori – Venice
    - Visualising Venice
  - Nolli – Roma interrota

Methodology – digital humanities (3)

- **Map**ping of affected churches (google maps, arcGIS online, after creating a CSV table with data)
  - ESRI Story maps, StoryMap+Gigapixel
- Image annotation (and linking through story maps)
  - ImagePlot
- Omeka to create an exhibition (other than the story map)
  - Netline for mapping changes over time
- Model according to **3D** as for Lisbon the damages to come over the 28 models of Lagomarsino based on the description in Borovsky's book
  - Sketchup and Google Earth, cityengine (together with maps)
- **Zooming** between levels with Prezi
- Palladio to combine maps and timelines (ex. the series of earthquakes, other catastrophic events)
- ORA or other network software (Gephi) for networks

Results

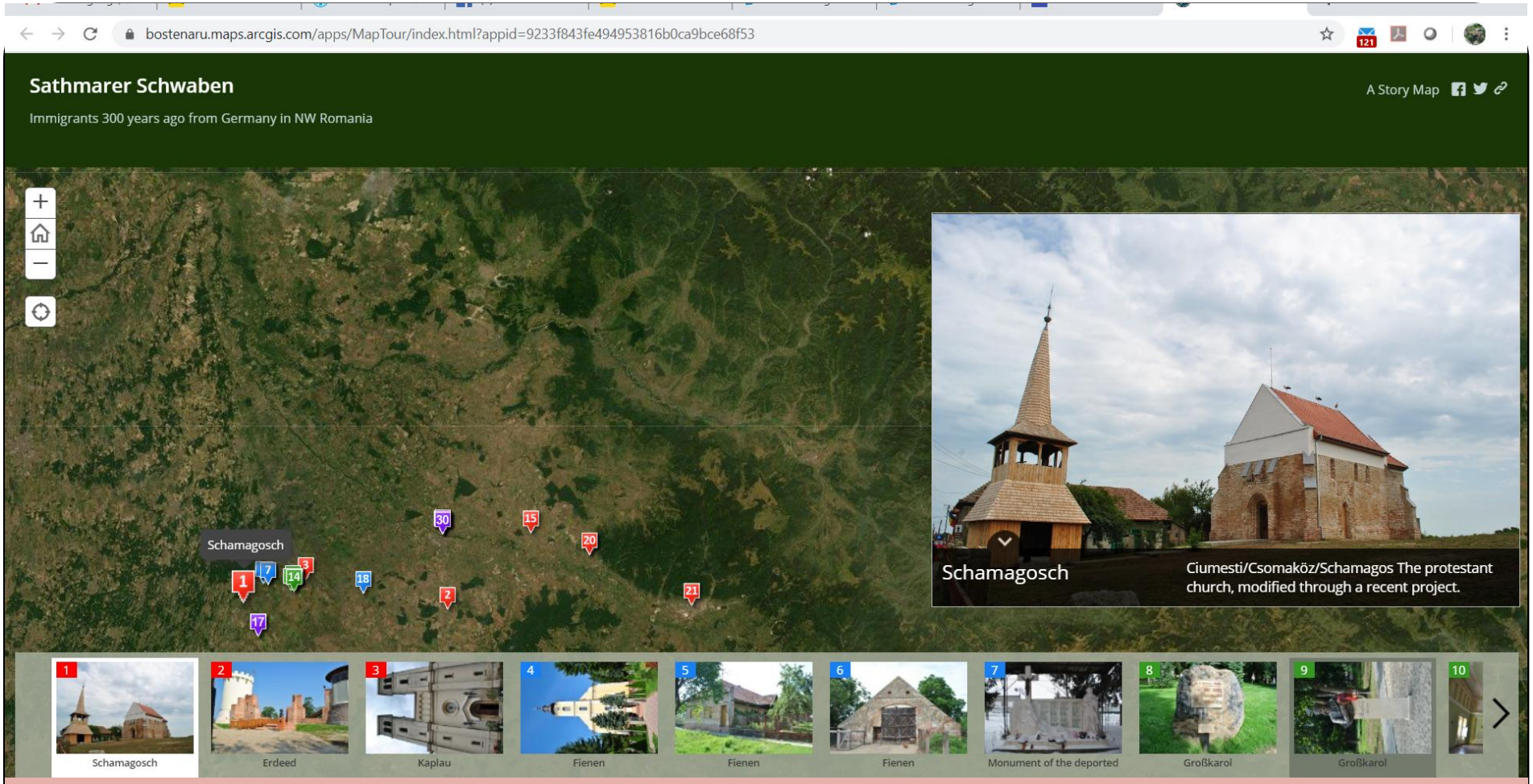
Results

- Migration
- Earthquake
  - Church buildings
  - Vernacular buildings
- Nature in the area

Migration

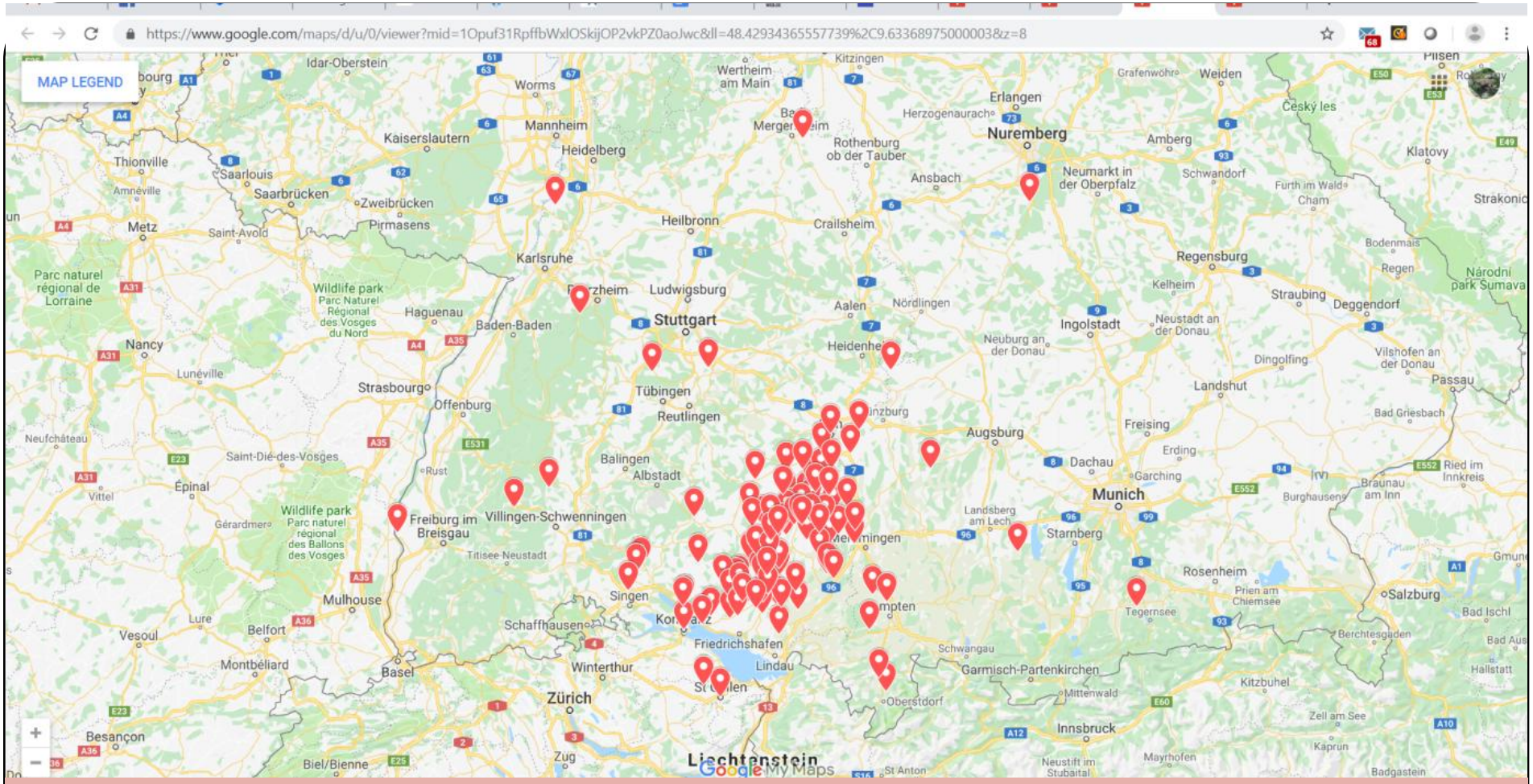
Donauschwabenufer

A plate on the Danube shore in Ulm, Germany, commemorating the places where Sathmar Swabians settled: 31 localities founded in the 18th century



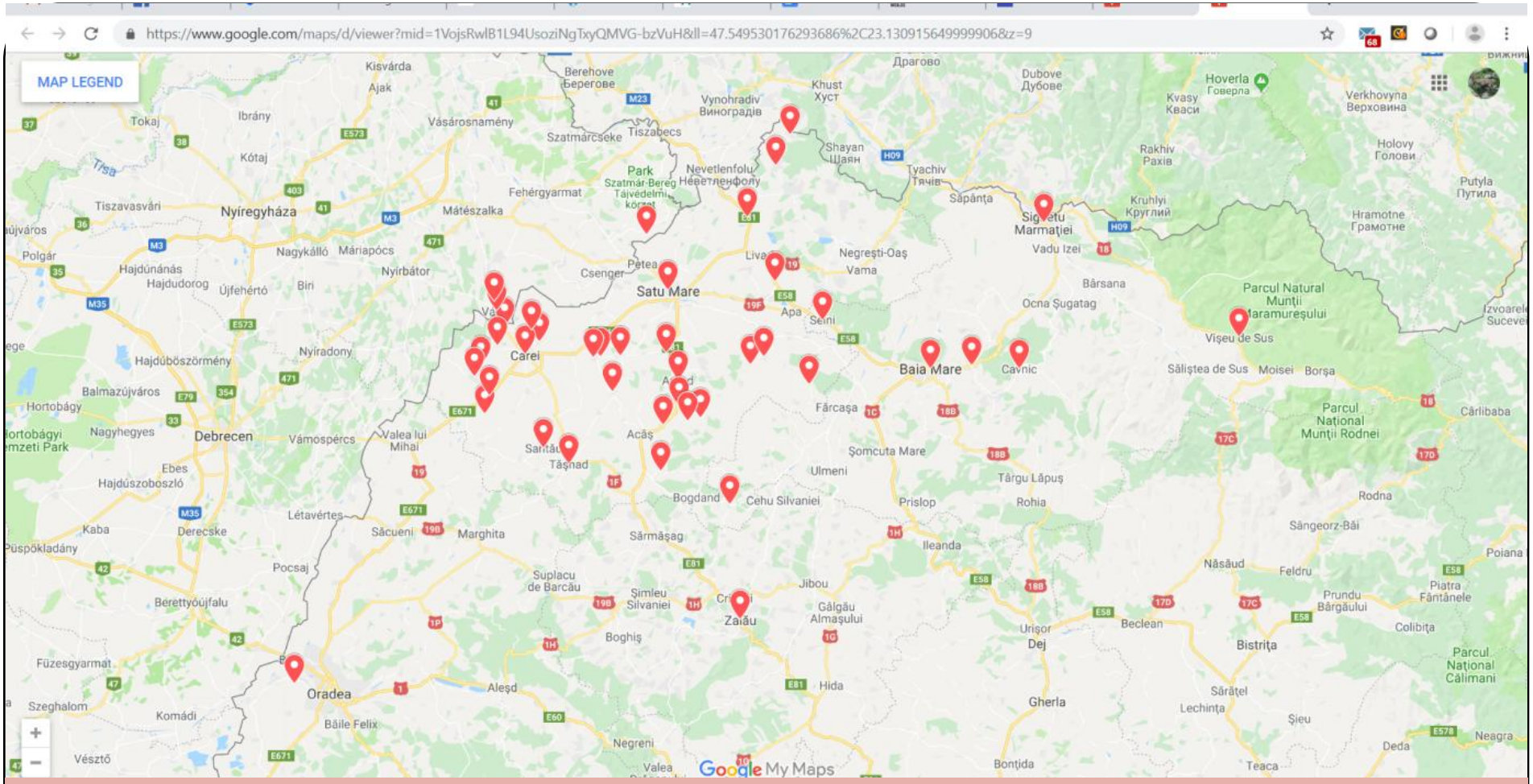
Story map of Sathmar Swabians

https://arcg.is/1m1PGu



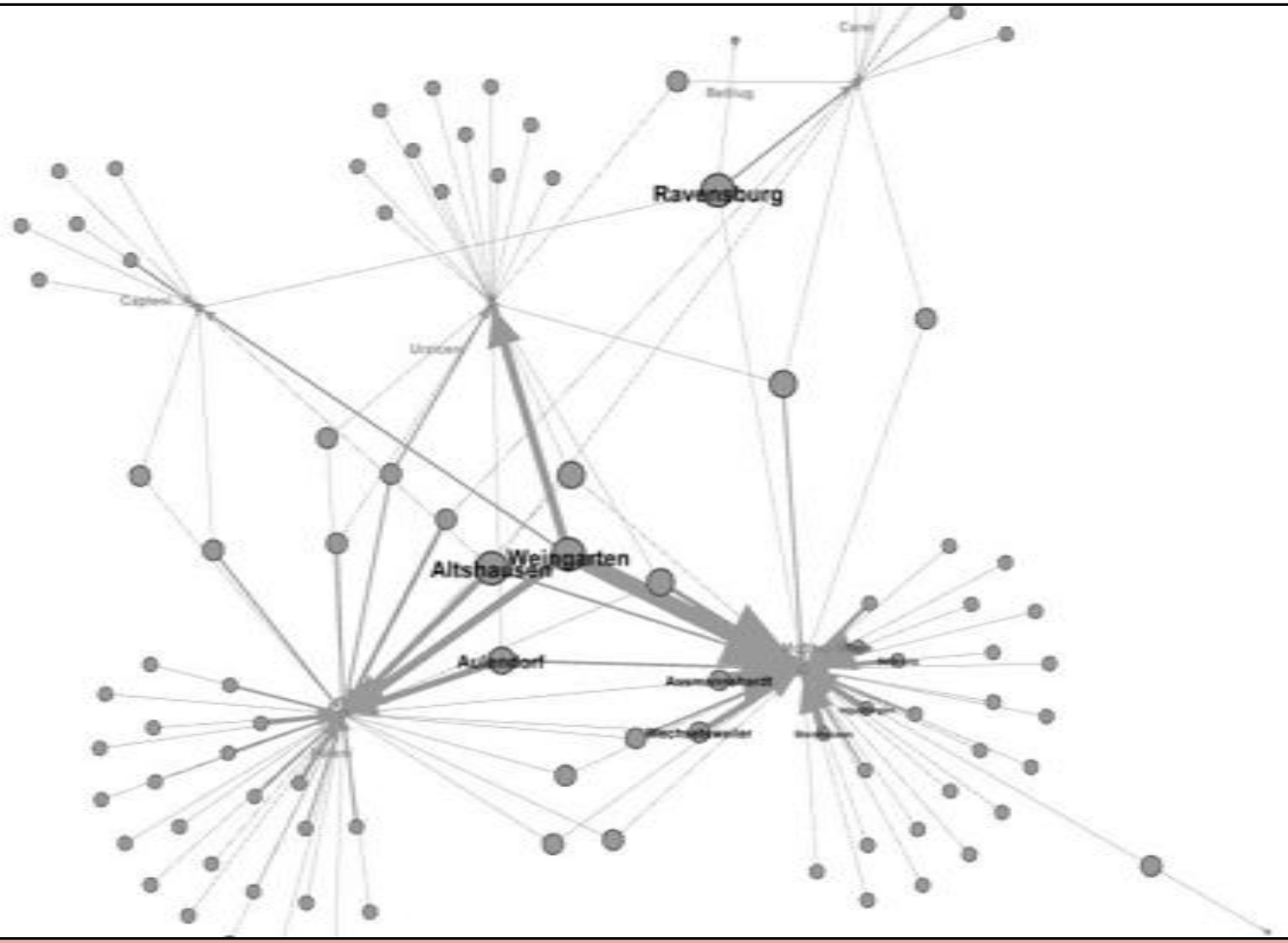
Oberschwaben

The localities of origin of Sathmar Swabians in SW Germany.



Satu-Mare

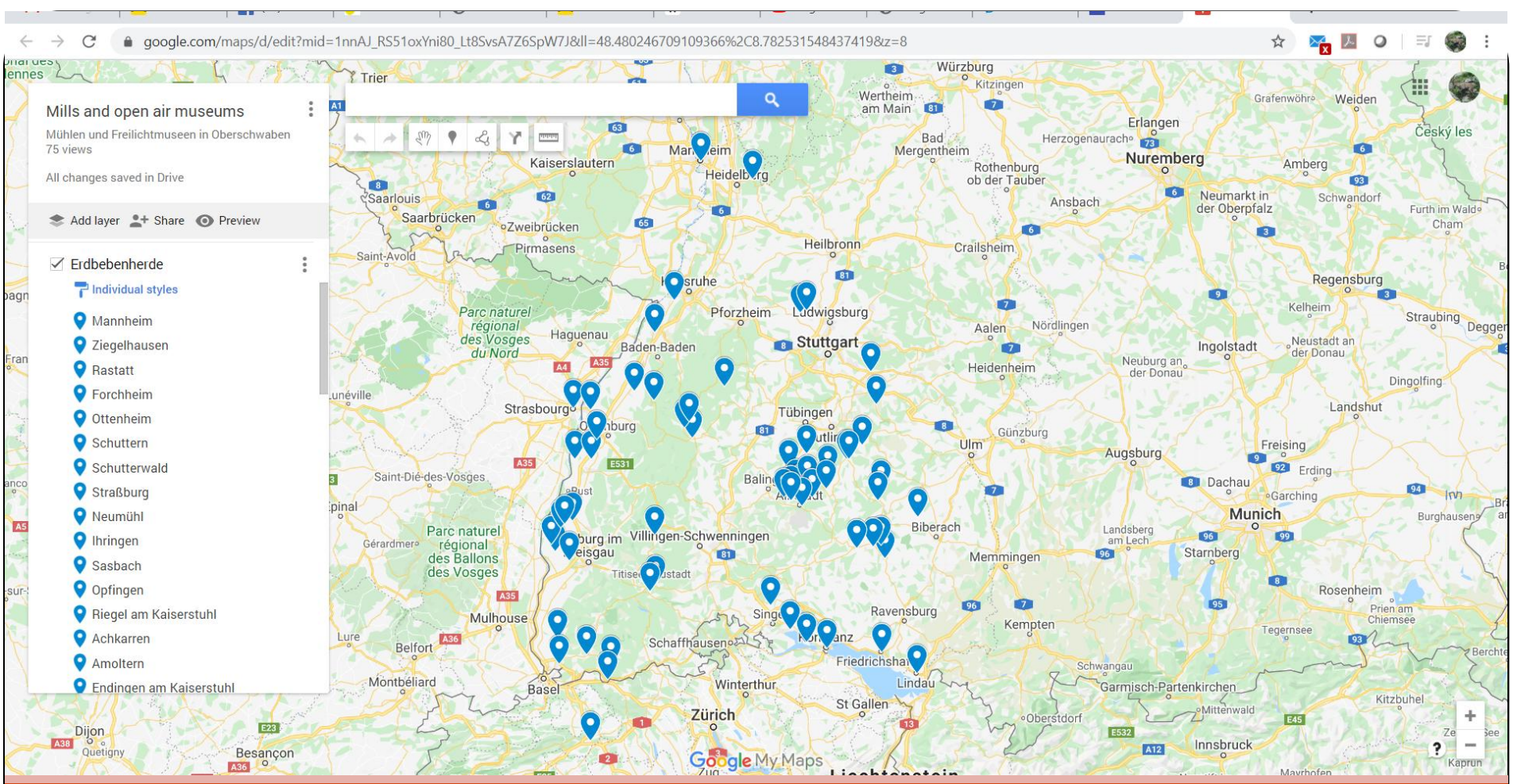
The places where the Swabians settled in Sathmar, NW Romania



Gephi

Network analysis of the localities most Swabians came from

1834 Érmellék earthquake



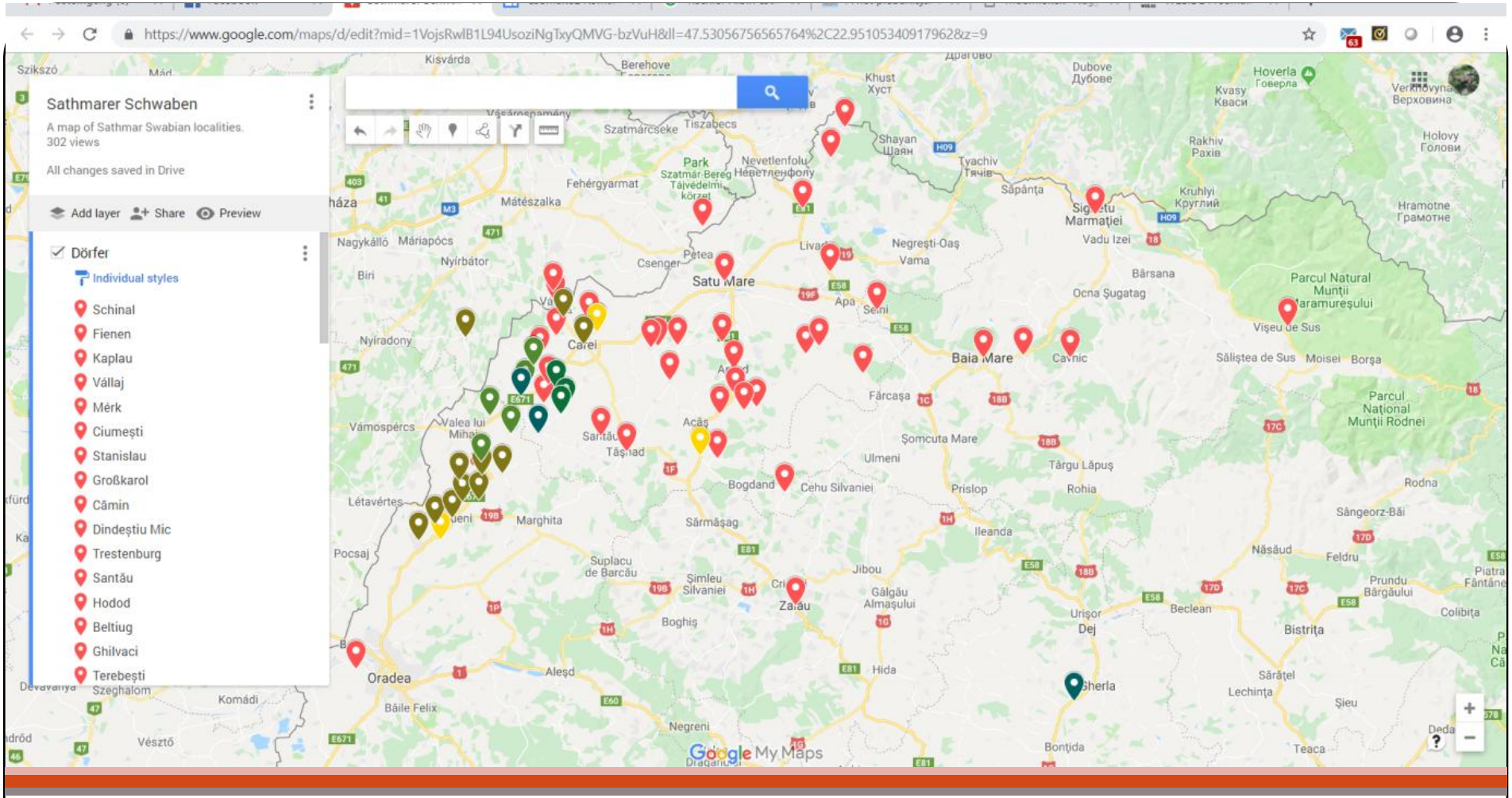
Earthquakes epicentres in SW Germany

Earthquake epicentres in the origin area of Sathmar Swabians. It can be observed that many earthquakes are in the Rhine valley and thus a different region, but also around the Boden lake.

Full map here:
https://drive.google.com/open?id=1nnAJ_RS51oxYni80_Lt8SvsA7Z6SpW7J&usp=sharing

Earthquakes in SW Germany

- Catalogue https://meetingorganizer.copernicus.org/ESC2016/ESC2016-402.pdf
- Schneider, G. (1968). Erdbeben und Tektonik in Südwest-Deutschland. Tectonophysics 5 (6):459-511
- The houses in the museum in Kürnbach are older, but probably because only more recent houses remained in Sathmar they are not anymore the same typology. But the oldest wine cellar is from 1807, before the earthquake.



1834 Érmellék earthquake

Dark blue: epicentre, and towards yellow the intensity decreases. Data after Zsíros (1981), based on damage to vernacular houses. In red not affected Sathmar Swabian settlements.

Full map here: https://drive.google.com/open?id=1VojsRwlB1L94UsoziNgTxyQMVG-bzVuH&usp=sharing

Érmellék earthquake

- Expecting earthquakes in the Érmellék and Nyírség areas (Várható földrengések Érmellék és Nyírség területén) by Szeidovitz Gy., Gribovszki K., Hajosy Adrienne https://www.researchgate.net/publication/287947190 - presents among others in Fig. 1 the fault
- the epicentre of the earthquake laid between Dindeşti, a village of Andrid, Andrid, Piscolt and Galospetreu. Dindeşti (Dengeleg in Hungarian) was a village with also German population, since the comune belonged for a while to the Károlyi family. Here, like in other cases in the presentation, the tower of the Greek catholic church (built 1800) collapsed in the earthquake. Tiream and Santău in the affected area are other localities in the Satu-Mare part of Câmpia Ierului with Swabian population, in fact, with notable Swabian population even today.

Érmellék earthquake

- BIGSEES project (http://infp.infp.ro/bigsees/Results.html , for the map https://www.arcgis.com/apps/webappviewer/index.html?id=050213a7717846d2b42a5598d9a2e8e0) shows some of the earthquake sequence
- Zsíros: https://link.springer.com/article/10.1556/AGeod.41.2006.2.8) but also free here https://www.emidius.eu/AHEAD/query_study/popup_pdf_eq.php?study=ZSIR008&rec_id=30641 – the intensity was established following common buildings
- http://epa.oszk.hu/03400/03436/00158/pdf/EPA03436_magyar_geofizika_2000_02_075-084.pdf (article in Hungarian, but the figure legend is also in English) with map

Simulating intensities of historic earthquakes

- 1763 Komárom earthquake, using common vernacular buildings
  - Eduardo José de Azevedo Charters Fuentes Morais: Estimation of the Intensities of Historical Seismic Events in Moderately Seismic Regions, Based on the Damage Analysis of Hungarian Historical Buildings, Pál Vásárhelyi Doctoral School, Budapest University of Technology and Economics, Budapest, Hungary, November 2018.
  - E. Charters Morais, L. G. Vigh & J. Krähling (2019) Cyclic Behaviour, Dynamic Analysis and Seismic Vulnerability of Historical Building Archetypes in Hungary, International Journal of Architectural Heritage

Series of earthquakes: 2016 Central Italy earthquakes

- Cescatti, E., Salzano, P., Casapulla, C. *et al.* Damages to masonry churches after 2016–2017 Central Italy seismic sequence and definition of fragility curves. *Bull Earthquake Eng* **18,** 297–329 (2020). https://doi-org.ub-proxy.fernuni-hagen.de/10.1007/s10518-019-00729-7
- In a special number from Nov. 2016: Penna, A., Calderini, C., Sorrentino, L. *et al.* Damage to churches in the 2016 central Italy earthquakes. *Bull Earthquake Eng* **17,** 5763–5790 (2019). https://doi-org.ub-proxy.fernuni-hagen.de/10.1007/s10518-019-00594-4
- Graziani, L., del Mese, S., Tertulliani, A. *et al.* Investigation on damage progression during the 2016–2017 seismic sequence in Central Italy using the European Macroseismic Scale (EMS-98). *Bull Earthquake Eng* **17,** 5535–5558 (2019). https://doi-org.ub-proxy.fernuni-hagen.de/10.1007/s10518-019-00645-w
- Claudia Canuti, Sandro Carbonari, Andrea Dall'Asta, Luigino Dezi, Fabrizio Gara, Graziano Leoni, Michele Morici, Enrica Petrucci, Andrea Prota & Alessandro Zona (2019) Post-Earthquake Damage and Vulnerability Assessment of Churches in the Marche Region Struck by the 2016 Central Italy Seismic Sequence, International Journal of Architectural Heritage

Series of earthquakes: 2016 Central Italy earthquakes

- Photography collection at KHI (Art History Institute) Florence within the project Art History and catastrophe https://www.khi.fi.it/de/aktuelles/ausstellungen/fotografie-und-katastrophe.php
- Earthquake of Norcia in the 19th century in the Canadian Centre of Architecture collection (former support grant)

Series of earthquakes – cummulative damage

- Consequences of earthquake sequence: next earthquake is on predamaged structure (see my research in Karlsruhe). Cummulative damage see the second slide on Central Italy earthquakes.

Impact on church buildings

Church	Building data	1834 earthquake effect
Reformed church in Ciumești	Built in the Middle Age	1841 replacement of the crown (webpage of the commune)
Roman-catholic church in Ciumești	(1854-1856) architect Albin Tischler	The first small church built 1815 suffered damages and it was decided to rebuild it. (webpage of the commune)
Church in Căpleni	(1842-1848) architect Ybl Miklos	Built in frame of post-earthquake reconstruction.
Church in Moftinu Mare	1793-1797 architect Josef Bittheuser	It did not suffer notable damages (Bara, 2016)
Kalazanci Szent József roman-catholic church in Carei	(1769-1779) architect Franz Sebastian Rosenstingl	The tower collapsed, Miklos Ybl rebuilt it as lower tower. (description in the church)
Reformed church in Carei	enlargement 1746 – 1752 architect Josef Bittheuser	The tower leaned, the head of the tower and the bells felt down. 1836 on June 26k a fire happened and damaged the roof. The tower was repaired 1877 and covered with new metal. (Bara, 2016)
Church in Șandra	1781 Architect Josef Bittheuuser	In frame of the post-earthquake repair works a flat roof was built except of the spaces along the altar and the organ. (Bara, 2016)
Church in Petrești	1784-1786 architect Josef Bittheuser	The tower was damaged, and felt over the main nave. In frame of the post-earthquake repair works the vaults were replaced by a flat slab except around the altar. 1861 the tower was also rebuilt. (Bara, 2016)
Church in Foieni	(1783-1785) architect Josef Bittheuser	Damaged. The tower leaned, the peak of the tower was damaged as well, and it was repaired in 1838. (Bara, 2016)
Greek-catholic church in Carei	(1737−1739)	Strongly damaged, but it was repaired. 1888 it was repaired again. (zothmar.ro)

Literature for the damages

- Júlia Bara: PATRONAJUL ARTISTIC AL FAMILIEI KÁROLYI ÎN CAREI ŞI ÎMPREJURIMI ÎN SECOLUL XVIII, UNIVERSITATEA BABEŞ-BOLYAI, FACULTATEA DE ISTORIE ŞI FILOSOFIE, ŞCOALA DOCTORALĂ "ISTORIE, CIVILIZAŢIE, CULTURĂ„ defended 30th of November 2012, available at http://193.231.20.119/doctorat/teza/fisier/659 (in Romanian)
- Júlia Bara: Date noi privind construcţia bisericii Sfântul Iosif de Calasanz din Carei (New Data Regarding the Construction of the Saint Joseph Calasanz Piarist Church in Carei), In: Studia Universitatis Babeş-Bolyai. Seria Historia Artium, LVI, 1, 2011, pp. 59 - 77 (in Romanian)
- Júlia Bara (2016): Joseph Bittheuser (1755–1828), a Károlyi család uradalmi építészének tevékenysége Szatmár megyében. In: Fundálók, pallérok, építészek Erdélyben. Szerk: Orbán János. Maros Megyei Múzeum; Erdélyi Múzeum-Egyesület, Marosvásárhely; Kolozsvár, p. 53-90 (in Hungarian).
- Terdek Szilveszter, Vadas Krisztian: A nagykárolyi görögkatolikus egyházközösség története
- Ciumesti:

  https://www.sites.google.com/site/csomakozeskornyeke/home/csomakoezi-romai-katolikus-templom
  - https://www.sites.google.com/site/csomakozeskornyeke/home/csomakoezi-romai-katolikus-templom
- http://zothmar.ro HURO project

Literature for other damages

- "Andrid. A cultural and historical guide" by The County Museum of Satu Mare
- Local seismic culture and towers of Saxon churches – see Emil-Sever Georgescu
- Borovszky Samu: Magyarország vármegyei és városai

Moftinu Mare - exterior

From 1797

- Architect Josef Bitthäuser

Moftinu Mare - interior

No notable damages

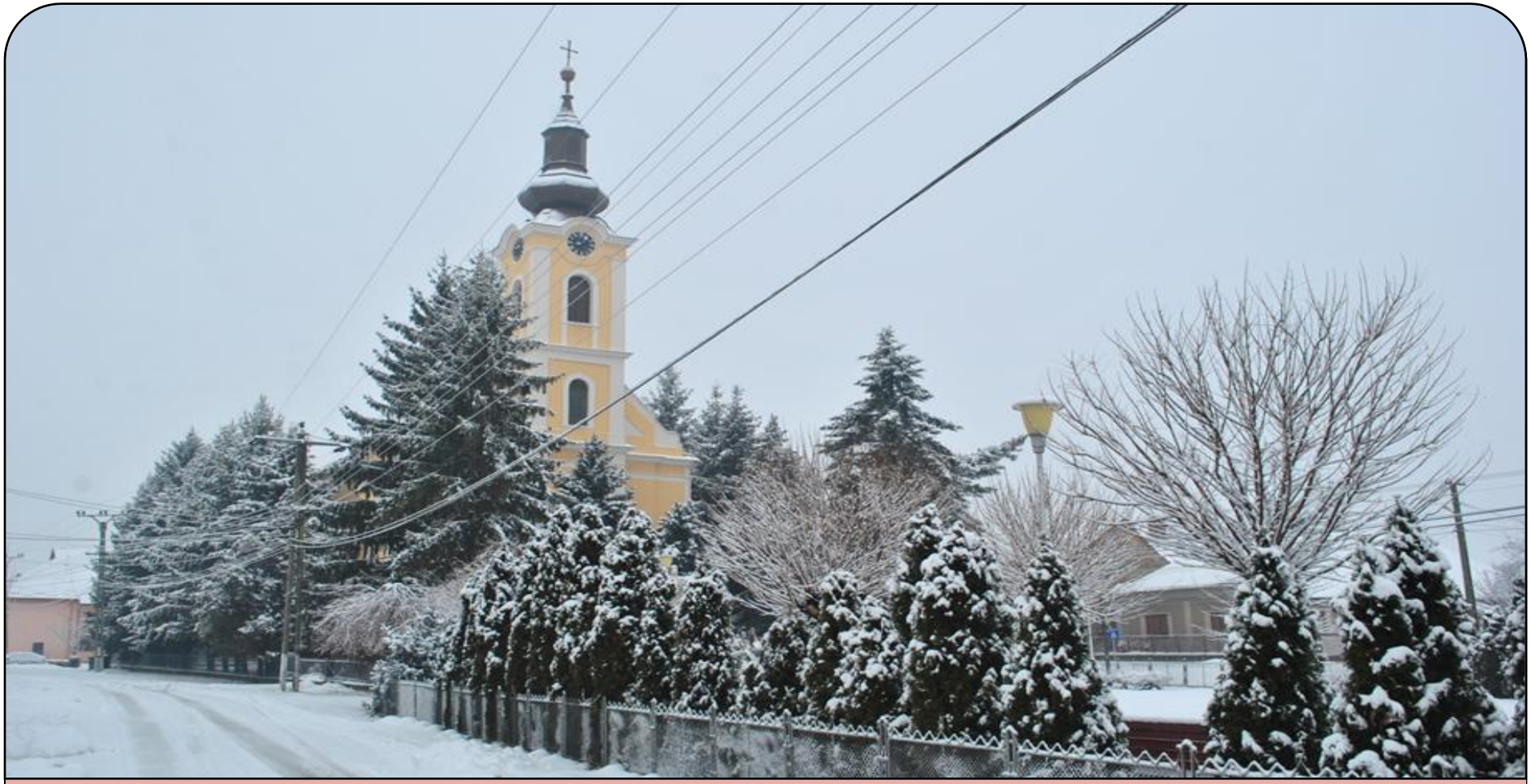
Petrești - exterior

From 1786

- Architect Josef Bitthäuser
- Tower was rebuilt 1861

Petrești - interior

The vaults were replaced with flat slab, as one can see, except of the altar (in the background) and around the organ.



Foieni

From 1785

- Architect Josef Bitthäuser
- Tower repaired 1838.

Foieni - interior

Here one can see how the original vaults of the architect might have looked like, as in other churches (Petrești, Șandra) except Moftinu Mare were not kept.

Reformed church Carei

Enlarged 1746 – 1752

- Architect Josef Bitthäuser
- Tower repaired 1877 after leaning and peak falling down as well as 1836 fire of the roof.

Reformed church Carei

Roman-catholic church Carei

From 1769-1779

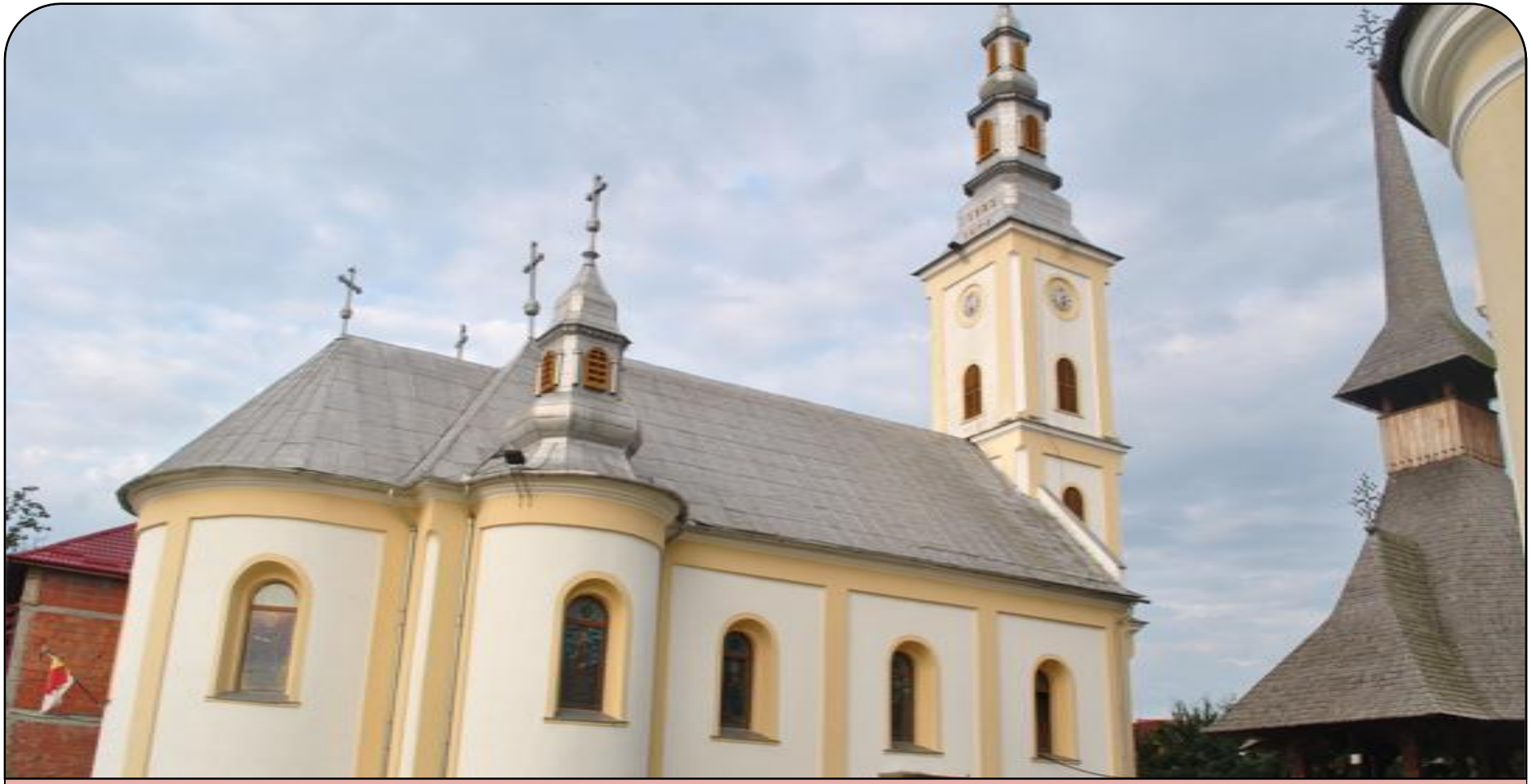
- Architect Franz Sebastian Rosenstingl
- The tower collapsed, Miklos Ybl rebuilt it as lower tower

Roman-catholic church Carei

- Greek-catholic church Carei - interior

Greek-catholic church Carei - interior

From 1739



Orthodox church Carei - exterior

About the same age as the Greek catholic church

Orthodox church Carei - interior

Churches in Andrid

- For this see the comments, it will follow in the next update

Conclusions – church building

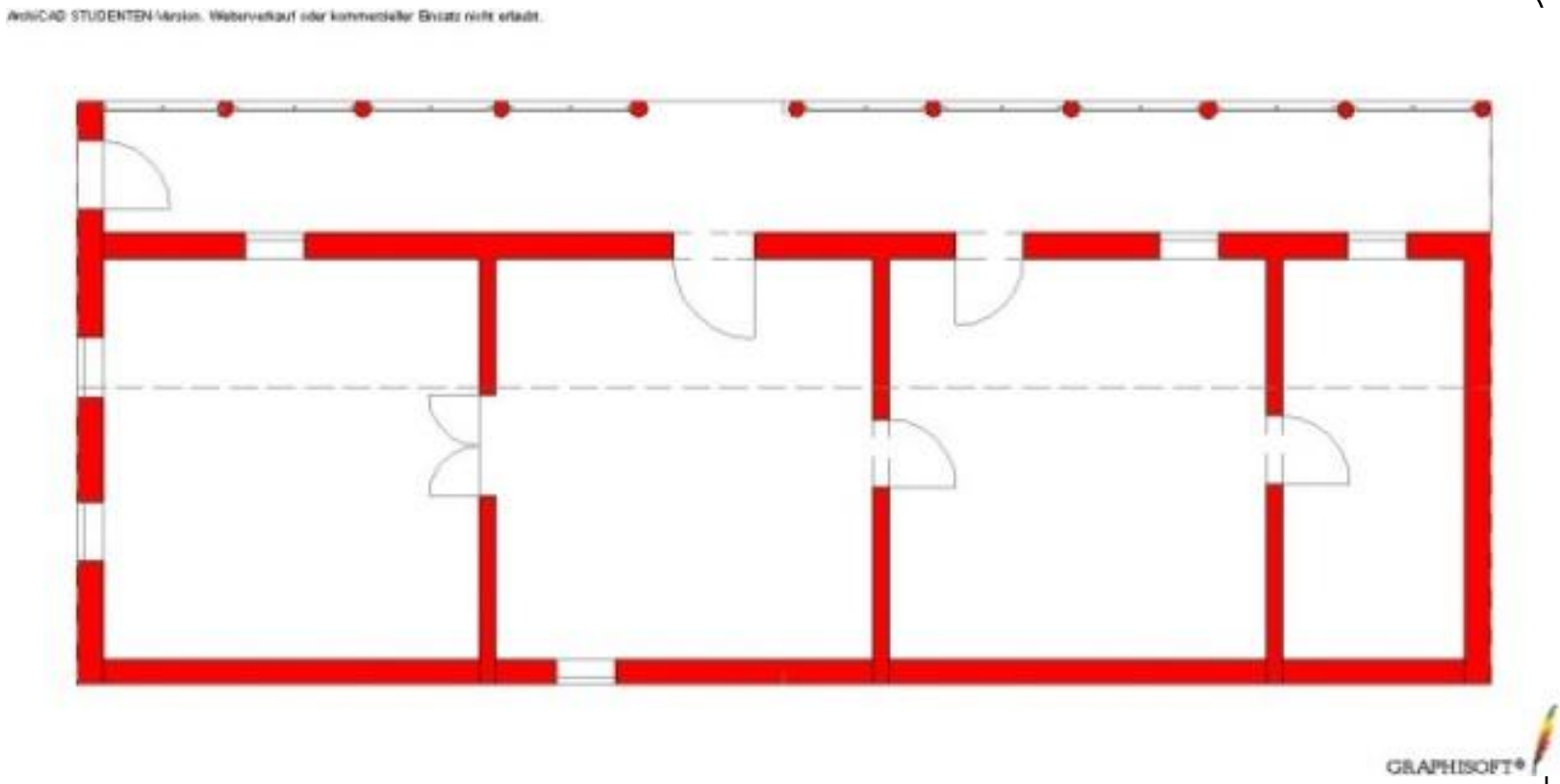
- In most cases when damaged occured in churches, this affected the towers.
- For this reason a macro-elements investigation as in the method of Sergio Lagomarsino is recommended.
- The place of origin also displays some earthquake epicentres, and thus architectural solutions might be similar.

Impact on vernacular buildings


Schwaben Wei
Riesling
VIN ALB SEC

3D model of a Swabian house

Report following the questionnaire of the World Housing Encyclopedia (in Cuvillier book)



Floor plan of a Swabian house

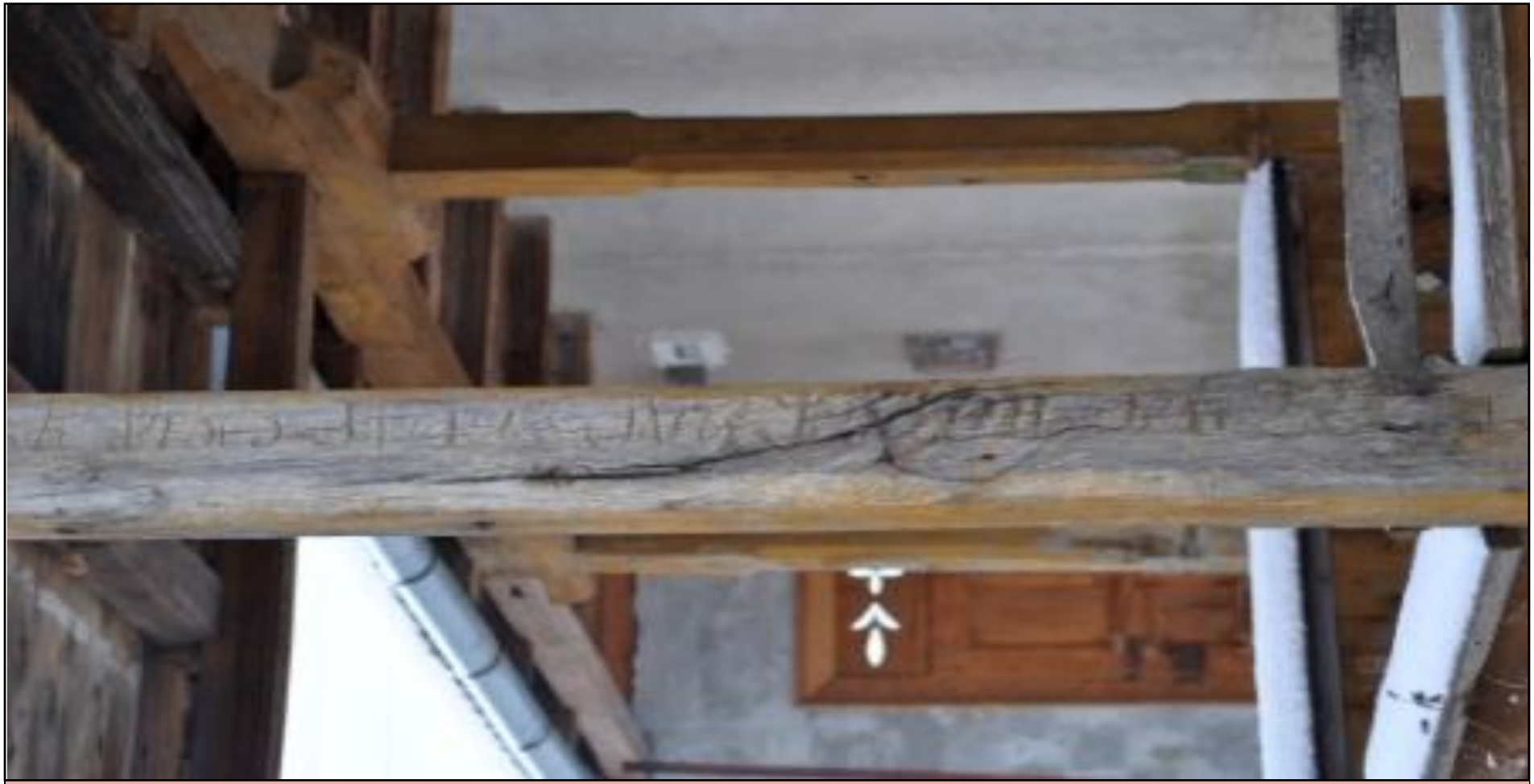
A langhouse

Swabian house of the ancestors before renovation (2014)

Swabian house of the ancestors during renovation (2019)

Master beam with authors of the house

Probably built 1848-1850 between marriage date and birth of first son date according to church records



Continuation of the master beam

Continuation of the master beam

Model of another Swabian house I‘ve seen

Extensions to a Querhouse

Model of a complex Swabian house

Photo of the house in the second model

Swabian room in the Danube Swabian museum in Ulm, Germany

Swabian house in the museum in Petrifeld

Swabian museum in Petrifeld, a house from 1871

Typical addition to a Swabian house

Interior

Conclusions – vernacular housing

- The postearthquake vernacular housing differs of the half-timbered and actually earthquake resistant housing (local seismic culture as himiş in Turkey and dhaji dewari in Nepal and gingerbread houses in Haiti or imposed as pombalino in Portugal and casa baraccata in S Italy) from the origin places.
- The postearthquake vernacular housing shows however features dictated by different agricultural use if we look at the village museum.
- Today remaining houses are postearthquake, hence, because the occurence of the earthquake, conclusions cannot be drawn regarding the migration of heritage with the settlers.

Nature in the area

Nature protection

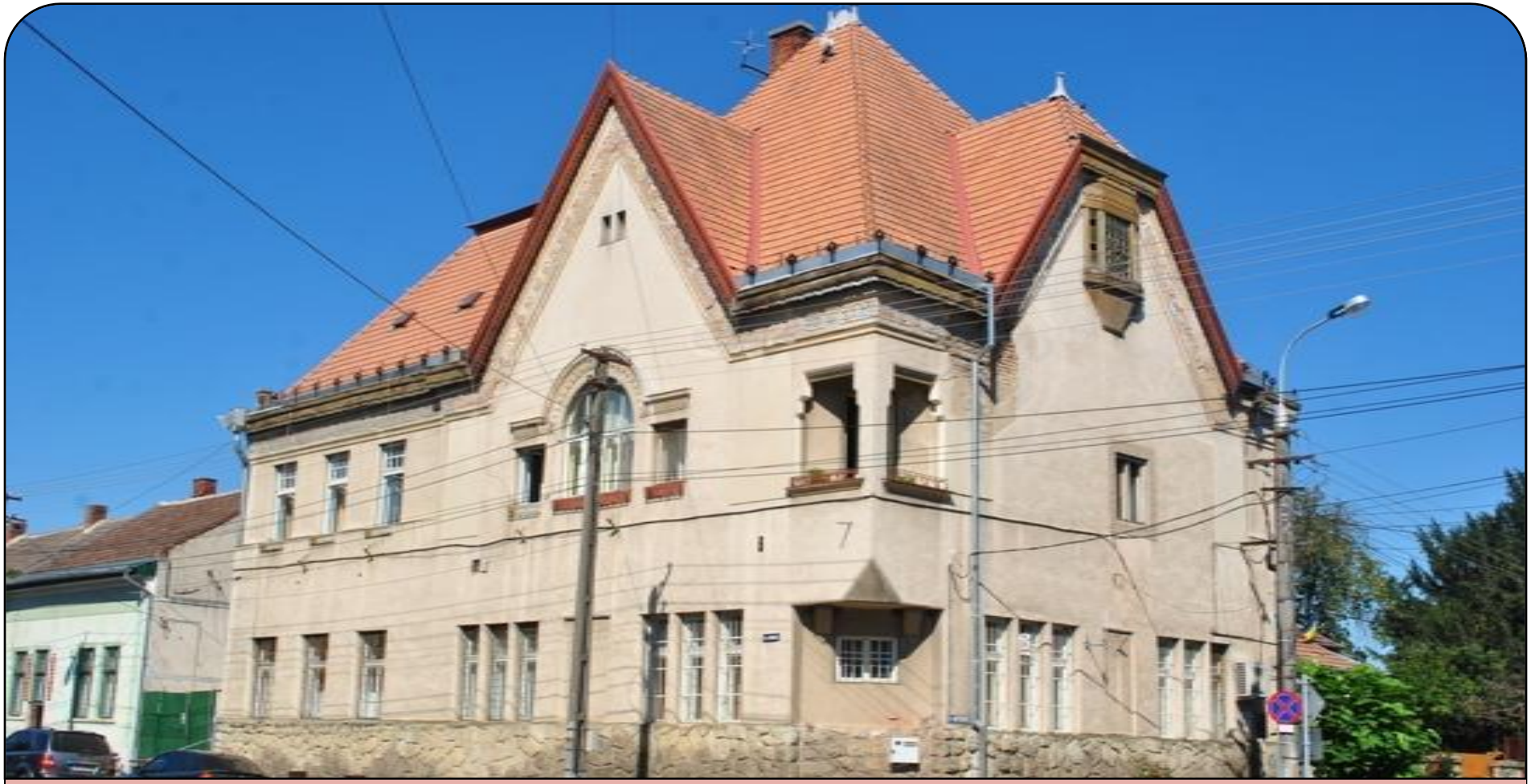
- There are festivals connected to nature: Andrid is part of the Stork village network at euronatur) and also for the acacia forests (in Valea lui Mihai the days of the town are called "blossoming acacia days" Nyíló akác napok in Hungarian)
- Valea Rece, a part of the Érmellék region (Valea Ierului), is IUCN IV classified.

Geology and geography and earthquakes

- The topography and geography are influencing both the nature and the earthquake vulnerability (the fault). For geology and geography of the area: http://zichykastelybihardioszeg.ro/hu/muzeum/ermellek-i-retegtan-foldrajz (in geologic times here was the Pannonian sea)
- Thermal water in the area may be in connection to earthquake vulnerability, see also http://publikationen.bibliothek.kit.edu/4702001 in hills as in mountains
-

Vernacular adapted housing to nature

- Vernacular housing has evolved and responds to the natural environment
  - Wine as geoproduct – the wine cellars alternative to auxiliary buildings (Tokaj is close) https://www.researchgate.net/publication/328656286_CONSERVATING_THE_TRADITIONAL_CELLARS_OF_SALACEA_BIHOR_COUNTY_ROMANIA (from a Romanian funded project). The kitchen blog is to integrate in the project
- More natural heritage than built heritage
- Valea Rece, a part of the Érmellék region (Valea Ierului), is IUCN IV classified.
- "Arhitectura tradițională din Valea Ierului - Împletiturile vegetale în construcții" by Tamás Czirják, dissertation work at the Technical University of Cluj, Romania, 2016 (available on issuu) – states that plans from origin places were taken over with local materials
  - Jürgen Kniep (2014) Houses. People. Stories [in German], Oberschwäbisches Museumsdorf Kürnbach, Bad Schussenried-Kürnbach, 64 pp., ISBN 978-3-9815212-1-4 (reviewed for UAC) - further research on plans
  - To look at village museums in Szentendre. Bucharest and Timisoara have from Banat, but there Viennaise model was followed (also controversy by Panasiu and Sabaila)

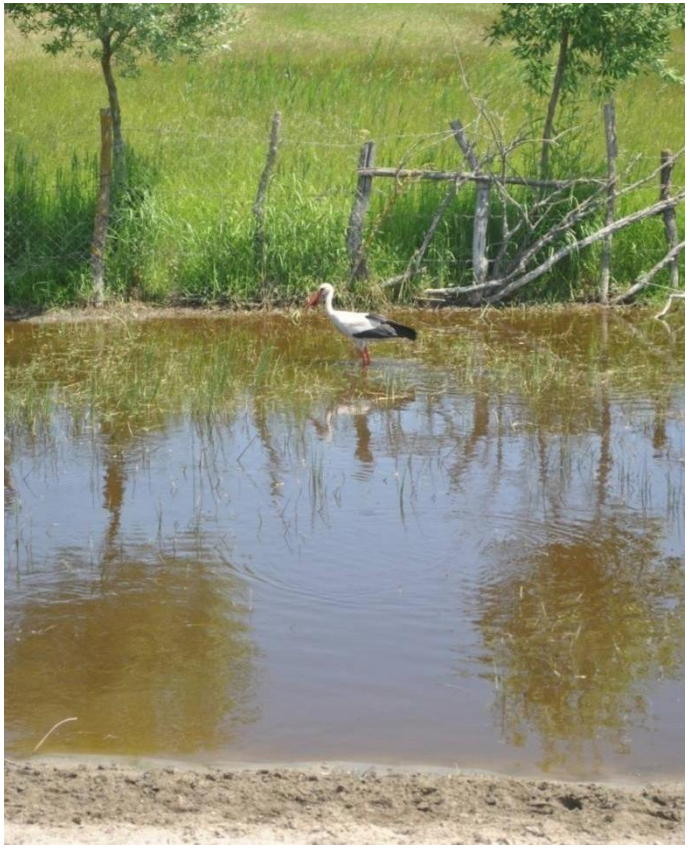


Administrative building of Ecsedi láp in Carei

An Art Nouveau building

The swamp dried out 1898

Andrid (Érendréd) stork village



Valea lui Mihai (Érmihályfalva) and open acacia days

Cross border landscape projects

- It is a cross border landscape
  - Heritage can be experienced through trails (geography) from different European projects – question on how to continue funding
  - Research as well as cultural and other projects can be done internationally
  - Le Notre forum 2020 on the topic
  - Also the Swabians made a bridge between origin place and colonisation place – cross border
- DANUrB looked similarly at pairs of cities
- Similarities with the Iron Gate: Danube Swabians, 3 countries, from which one is not EU (which gives differences in funding schemes)

Cross border landscape projects

- "Conservarea, protejarea și promovarea valorilor naturale din zona transfrontalieră Salonta – Békéscsaba, ROHU-14 – The Nature Corner“ https://www.dropia.eu/
- "The presence of the forest in the city of Karlsruhe, Germany and Carei, Romania – occasion for cultural events", published in Argument 5/2013 listing some such projects
- http://zothmar.ro
- http://swabusiness.eu , between Petresti and Vállaj, valorising architecture on one side and culinary tradition on the other.

Cross border landscape projects

- German projects
  - https://sathmarerspuren.de/projekt/ (incl. kitchen – for agrotourism)
  - http://sathmarerschwaben.yellowbox-server.de/index.php
  - https://www.facebook.com/sathmarerschwaben
- Numerous museums and research centres
  - Eastern Europe Germans including Swabians in Freiburg
  - Danube Swabians in Tübingen – with a project to Sathmar Swabians in the interwar time
  - Danube Swabian museum in Ulm – with the Sathmar Swabian room

Geoproducts and EGU

- https://writingurbanplaces.eu/wup-news/socially-distanced-cooking-and-photography/

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More about the project here:

https://sites.google.com/view/domusszulofoldiosztondij/

Continued during the Domus scholarship in the home country, 2020, on the landscape part.

All photos by the author.

Thank you!
Questions?