ACTA CLIMATOLOGICA
Universitatis Szegediensis, Tom. 32-33, 1999, 51-64.

SOME WEATHER EVENTS IN THE FOURTEENTH CENTURY II. (ANGEVIN PERIOD: 1301-87)

A. KISS

Deptartment of Climatology and Landscape Ecology, József Attila University, P.O.Box 653, 6701 Szeged, Hungary. E-mail: kissandi@sol.cc.u-szeged.hu

Összefoglalás - A vizsgálat célja - egy, a korábbinál nagyobb adatbázis alapján - annak bemutatása, hogy a klimatörténeti kutatásokban az eddig talált források milyen lehetőségeket nyújtanak egy lehetséges klímarekonstrukcióhoz. A dolgozat kizárólag az egykorú, vagy közel egykorú, megbízhatónak vélt anjou-kori (1301-1387), elsősorban írott források csoportját érinti. Mivel a rendelkezésre álló adatok mennyisége nem enged meg konkrét klímarekonstrukciót az adott időszakra, így a dolgozat másik célja, hogy a bemutatásra kerülő adatokat összevetve a rendelkezésre álló, a korszakra vonatkozó európai, de különösen közép-európai adatbázisokkal, bizonyos lehetséges összefüggéseket állapítson meg.

Summary - The aim of this study is to provide more evidence for a possible climatic reconstruction of the Hungarian Kingdom in the period of 1301-87, on an increased database of fifty, mainly contemporary sources. Another goal is to present the European, but especially the Central-European conditions at the same time in order to find some parallels between the European database and the data referring to the areas of the former Hungarian Kingdom.

Key words: climate history, weather events, floods of rivers, written sources, charters, 14th-century Hungary

SOURCES AND DATABASE

In this study, a database of contemporary written sources and archeological evidence were provided which refer to some weather events and also to some cases connected to the hydrological and climatic conditions of certain parts of the former Hungarian Kingdom from the period between 1301 and 1387. In addition, on the basis of the medieval database of the surrounding territories, another aim is to find possible connections, parallels between these databases and the records (mainly charters) reflecting on some weather events in fourteenth-century Hungary. Thus, this article is a continuation of an earlier study which was written on the same subject, but dealt with a shorter time period from 1338-1358 (*Kiss*, 1996). In this case, for a longer time-period, around one-third (about 10000) of the remaining charters from the Angevin period was investigated, mainly those which have been published in different collections. Moreover, the summary (regesta) collection of the

Hungarian National Archives was examined, and the available contemporary information on the hydrological conditions of the two largest lakes in the Carpathian Basin: Lake Balaton and Lake Fertő (Neusiedlersee) in the afore-mentioned period were also collected. This data collection consists of fifty direct or indirect records (*Table 1*) contained useful and reliable (in case of uncertainty, I noted it with a question mark in *Table 1*) information related to such weather and other environmental events as deep snow, frost, too great or unusual floods etc. Nevertheless, there are only few narrative sources, namely some Hungarian and non-Hungarian chronicles, which also contain a very limited amount of further information. On the other hand, the information content of the whole database is quite different from a database from a diary or a chronicle, in which the most remarkable events were usually emphasised. Here, we have separate sets of information: each data came from different charters (or, in some exceptional cases, from chronicles). Moreover, charters often provide quite accurate information about one particular day: the day on which a perambulation was made. From these charters, we learn little about the actual conditions (e.g. the beginning or the end of the event), only the fact that it exsisted on a given day. Most (80%) were connected to certain weather events, and a smaller group of sources (20%) rather reflect on the changing conditions in the previously mentioned period. (*Fig. 1*)

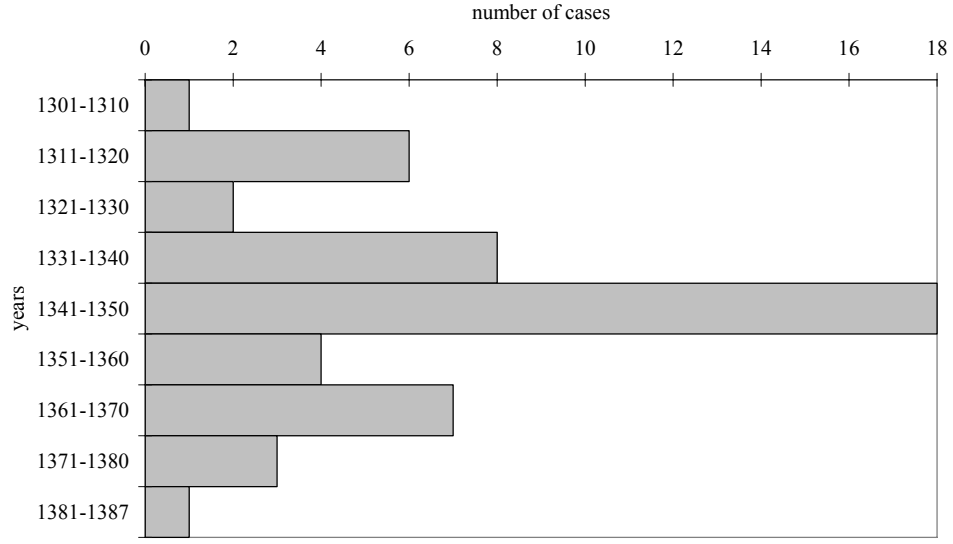

Fig. 1 Temporal distribution of the weather events between 1301 and 1387 in the Carpathian Basin

The spatial distribution of the fifty data is quite uneven: more than half of the information refer to the northern part of the kingdom while, for example, there are almost no sources related to the eastern and southeastern areas of the country (*Fig. 2*). This fact may be related to the relative lack of remaining contemporary sources in the southern and southeastern regions of the Carpathian Basin. The time distribution of the sources is also uneven: twenty of the fifty data are connected to events and conditions of the 1340s, which decade was also quite unfavourable in many other parts of Europe.

Although the number of sources and the type of events and conditions do not yield enough evidence to allow a proper reconstruction for any time in the fourteenth century, it is still important to compile a database in order to open up the possibility of a future comparison between the recorded weather and hydrological events of the former Hungarian Kingdom and other Central-European databases. Also, it could provide a basis for a future, larger collection of reliable sources refering to the medieval climatic conditions in certain parts of Hungary.

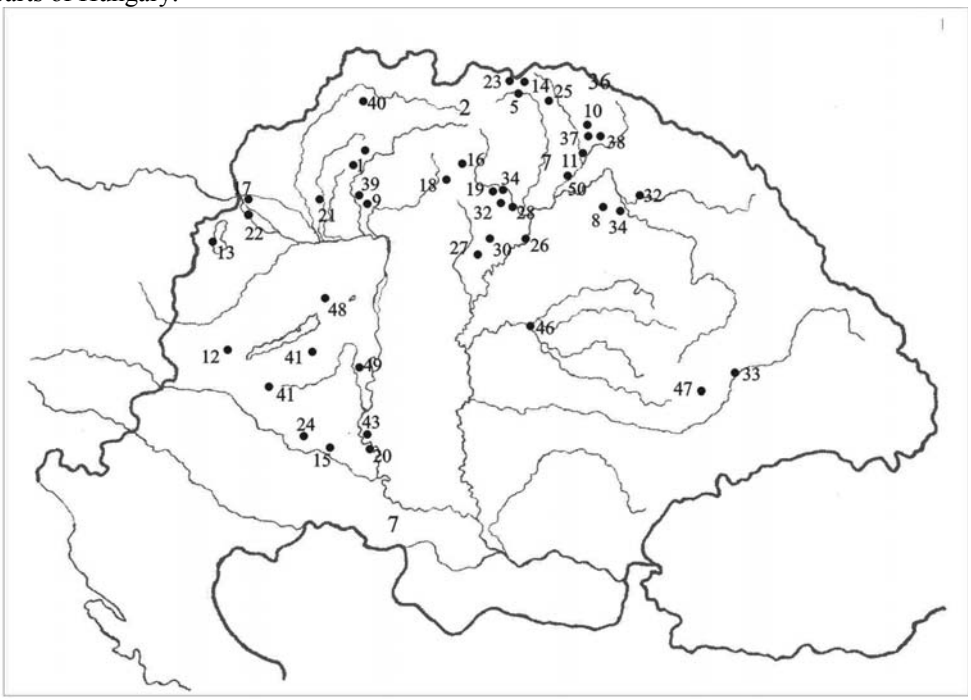

Fig. 2 Spatial distribution of the weather events between 1301 and 1387 in the Carpathian Basin

Andrea Kiss

THE CLIMATE OF EUROPE IN THE FOURTEENTH CENTURY

The fourteenth century was a part of a transitional period between the 'Medieval Warm Epoch' and the 'Little Ice Age' when the first signs of the climatic deterioration became obvious. The first years of the 1300s were the turning point for the climatic changes in most parts of Europe. The abandonment of marginal regions in Europe, which had earlier become inhabited during the Medieval Warm Epoch, began at the end of the thirteenth century and increased throughout the fourteenth century. From the 1300s, wet years were more frequent in the first decades of the century which caused poor harvests and famines particularly in the western and northern parts of Europe which were the most overpopulated regions at that time. Another sign of these changes was that a growing number of mines in the Alps and the northern mountains of Central-Europe had to be closed by the miners because of increasing amounts of water and the more extreme weather conditions (*Lamb,* 1988. 48). The average number of frosty days in May multiplied in England (*Lamb,* 1982. 168), and the population in the northern parts of Norway started to decrease dramatically (*Lamb,* 1982. 168). At the same time, shortly after 1300, a new, drier period began in the European territories of Russia and the severe winters became more frequent in the northern half of the Great Eastern-European Plain (*Lamb,* 1982. 196).

The period between 1310 and 1347 was especially wet in Western Europe (*Lamb,* 1988. 58). Because of these circumstances, the tree-line was 100 or 200 m lower in the higher mountains of Europe (*Lamb,* 1982. 195). During these wetter and cooler times, there were two periods which were enormously unfavourable for the population of Europe. Between 1303 and 1328 cold winters prevailed (*Pfister et al*., 1996. 100), while the following decades until the mid 1350's average winters were predominant without real extremities. (*Pfister et al*., 1996. 101) In 1342, the trade routes of the Vikings were replaced to the southern regions of the Atlantic ocean because of the great mass of ice around Iceland and other northern islands. Because of the unusal weather conditions, the harvests of these years were poor and from 1348 until 1352 one third of the population of Europe died from the plague and famine. The glaciers of the Alps attained their greatest medieval extent around 1350. After this time glaciers began to decrease again (*Lamb,* 1988. 44).

While in the western and northern parts of Europe wet climatic conditions dominated until the 1370s, in the Czech Kingdom dry summers became more common between 1360 and 1380. Winter temperatures of Europe were quite variable in the period of 1355-1375 with an extremelly severe winter of 1363/4 (*Pfister et al*., 1996. 101); in the Czech areas, mild winters dominated from 1340 until 1390, though between 1340 and 1370 these winters were not only unusually mild but quite dry as well (*Brázdil and Kotyza,* 1995. 161). Russia lived through one of the driest times in her history during the period between 1360 and 1380 (*Borisenkov-Paseckij,* 1983. 91-92). The winters of the last decades of the century were close to the temperature averages of the 'Little Ice Age' without great extremities (*Pfister et al*., 1996. 102).

In conclusion we can say that the climate of the fourteenth century was cooler and wetter in some parts, but more disturbed than in earlier times. This century was especially different from the previous centuries because of the new climatic effects on food production which were followed by a sharp decrease of population.

COMPARISON TO THE AVAILABLE SOURCES OF THE NEIGHBOURING AREAS

In comparison with European, but especially Central-European conditions, some parallels can be presumed, which should provide results after further examination. As a basis of comparison, the data, based on contemporary sources from the books of P. Alexandre and R. Brazdil and O. Kotyza, were used. Applying the database of *Table 1*, I refer only to those events for which I could find any comparison or even contradiction in the database from the surrounding territories.

No. 3-5.: There are at least three available sources which refer to river floods (even the Danube) in 1316, not only for Hungary but also for other parts of Central Europe such as Poland, as well as the Czech, the German territories and Poland (*Brazdil and Kotyza*, 1995. 111). High prices in the Upper-Hungarian area was also mentioned for 1316 in a charter written in 1342.

No. 7.: The serious freezing over of the Bodrog river could happen between 1316 and 1322. In the surrounding countries, the winter of 1317 was long and cold (*Alexandre*, 1987. 744). From this information we may presume that this event occured in 1317. On the other hand, the presence of King Charles Robert in the vicinity of the river - because of the political circumstances of the time (*Kristó*, 1988. 52) - would suggest that this happened in the next winter of 1317- 8 which was not really cold in other parts of Europe (*Pfister et al*., 1996. 104)

No. 8.: The inundation on the upper part of the Tisza river is quite important as it occured in the second half of February in 1325, and covered quite large areas in the northeastern part of the Great Hungarian Plain. It is interesting to note that there was a flood in on the Ohre river in the Czech Kingdom (*Brazdil and Kotyza*, 1995. 112, 234) "which was caused by a quick thaw of snow in the mountains".

No. 11-13.: The winter of 1334 and 1335 was very hard and snowy in the Czech territories (*Brazdil and Kotyza,* 1995. 235) and this was the prevailing condition in other parts of Europe (*Pfister et al*., 1996. 104) such as many parts of the French Kingdom (*Alexandre,* 1987. 755). Some parallels may be indicated in a charter which mentiones the fact that the flood around the 4th April, 1335 was too large: it was so serious that "the whole county of Ungvár in this area" was inundated. This large flood may also refer to the abundance of previous winter precipitation in the mountains.

The waterlevel of Lake Balaton was around 106 m above the Adriatic sea level in 1335 (today it is 105 m), but - as we know from an archaeological reconstruction - it rose

quite rapidly in the fourteenth century so that researchers were able to estimate the possible waterlevel in 1335. Concerning Lake Fertő (Neusiedlersee), there is more infomation which refers to some elements in the hydrological condition of the lake including meadows "*in Fertew*" showing that the waterlevel could not have been high at that time. On the other hand, the weather reports connected to the Czech lands probably has more connection to the rising waterlevel of Lake Balaton, since both the winter and the summer of 1335 were quite cold and rich in precipitation (*Brázdil and Kotyza*, 1995. 235).

No. 19-26.: For the year of 1342, seven data could be found which referred to weather events: this is a much higher number than in any other periods of the fourteenth century. This year was also rather difficult in many parts of Europe outside of the Carpathian Basin. The winter of 1341-2 was severe with much snow and great frosts in Moravia and the Czech lands (*Brázdil and Kotyza*, 1995. 235) and high prices were mentioned although without date (*Brázdil and Kotyza*, 1995. 236).

On the 1st February, in 1342, there was an early, great flood on the Vltava, Elba and Morava rivers which appeared with warm southern winds, thaw and rain (*Brázdil and Kotyza*, 1995. 236). Three days later, on the 4th February, a data refers to another flood which occured on the Szinva river, in the lower, southern region of the northeastern Carpathians. The exact date of the beginning of this flood is uncertain, but the flooding was already occuring on the afore-mentioned day. Therefore, we can presume some parallels between the meteorological and hydrological events in these two areas. Other floods were also reported from the same year on the Zsitva (*Table 1*) and then, probably on a land, not far from the Lower-Danube (*Table 1*). Concerning the hydrological conditions of the river, it is even more possible as the winter was also snowy in the montainous parts (Alps) of the catchment area of the Danube. Moreover, the autumn floods of the Dráva river in the southwest and of the Tapoly and Ondava rivers in the northeastern part of the country were also reported which may also have certain parallels with the weather conditions of other parts of Europe.

No. 30-31.: In the spring of 1346, another great flood of the Tisza river was mentioned in a charter: this event has probable connections to the weather in certain parts of Europe (*Alexandre*, 1987. 756).

No. 34.: In the middle of January in 1349, there was a serious flood on the Tisza, which influenced large areas in the northeastern parts of the Great Hungarian Plain. Additionally, the winter in Austria was heavy in precipitation. The same was also true for Styrie and Carinthie (*Alexandre*, 1987. 247).

NO. 36.: In 1352, the king's army crossed the northeastern Carpathians, through the so called Ruthenian Mountains. Although the exact date of the event is still uncertain (end of winter, beginning of spring), during the four days, when they were crossing the mountainous area, they had to walk in deep snow which reached the saddle of the horses.

No. 40.: In the mountainous villages of the northwestern Carpathians, deep snow was described for the first part of May, 1361. The winter of 1361 was also quite severe in

Austria (*Alexandre*, 1987. 249).

No. 41-42.: The deep of snow and the severity of winter was mentioned in 1364, referring to large areas (lands in two different counties) south to Lake Balaton, in the Transdanubian region. In the same year, the winter was also severe and snowy in many parts of Europe (*Alexandre*, 1987. 249), and was mentioned as perhaps the most severe winter of the period (*Pfister et al*., 1996. 102). These circumstances could have caused the problems in food supply and the high prices in the country, in 1364, as well (*Table 1*).

Clearly, only around half of the sources can be compared to any kind of information connected with contemporary weather conditions in the surrounding territories.

CONCLUSIONS

This database can provide good, but mainly everyday examples which makes it imposible to reconstruct the beginning, the duration and the end of given meteorological event. The amount of information is so few that reconstruction cannot be made. Many of the examples refer to hydrological events or the abundance of precipitation. Another part is connected to unusually cold temperatures. Because of the type of the source material, other types of weather events or changes could appear only exceptionally in the charters (such as high prices etc.)

Concerning the relative lack of proper narrative contemporary sources - related to the weather events of the Hungarian Kingdom - we cannot reconstruct the probable influences of the climatic changes of the fourteenth century. However, using the evidence from written sources and archaeological research, and comparing the collected data to the Central and Western European databases, some parallels can be recognised.

Table 1 Records of weather and hydrological events in Hungary in the period between 1301 and 1387

number of data	source	county	place	year	month, day	event	floods of rivers
1	AOklt. 2/296	Bars	Lehotka, Garamszent-benedek	1309	-	frequent floods	Garam
2	G. Hain Chr., 17		Szepesség	3 years around 1312	-	famine	-
3	Chron. Leob. 33-34		Hungary	1316	-	flood	Danube
4	Chron. Aulae Reg. Lib. 1/128, CM 511.		Hungary	1316	-	unusual weather, continuous rains, floods	
5	Schmauk 2/93.o.	Sáros	Pécs-Újfalu	1316	-	high prices	-
6	AOklt. 7/48	Szerém (?)	Száva river	1319	winter	vicissitudinous weather	-
7	DL 99892	Zemplén (?)	Bodrog river	Before 1322	winter	thick ice on the river	-
8	DL 96117	Szatmár	Vetés, Voja	1325	21 February	flood	Tisza, Kraszna, Tur
9	AOklt 12., DF 282744	Hont	Szántó	1328	between 8 Nov. and 2 Dec.	vicissitudinous, winter weather	-
10	DL 102897	Ungvár	Tasolya, Pálóc	1334	beginning of April	flood	Ung and its tributaries
11	AO 3/161	Ungvár	Szelmenc and this part of the whole county	1335	4 April	flood	Ung and its tributaries
12	Zala 1/294-307	Zala	Zalavár	1335	June	rising waterlevel of the Balaton	-
13	Bgl.4/87-8	Sopron	Széplak	1335		the waterlevel of the lake is not high	Lake Fertő
14	Fejér 8/4/364	Sáros	Trocsány, Cherocyna, Remete	1338	1 May	deep snow and great flood	near the Tapoly
15	AO 23/329-30	Baranya	the (ferry) harbour at Eszék	1339	bime of inundation	inundation	Dráva

number of data	source	county	place	year	month, day	event	floods of rivers
16	AO 3/597	Gömör	Csoltó, Lekenye	1339	before 31 August	flood	the waters of the Sajó and Halbokapataka
17	Fejér 8/4/488	Pozsony	Páka	1340	25 July	too wet and muddy meadow	near the Danube
18	Kub. 2/160	Gömör	Harmac	1341	8 November	flood	Rima
19	DL 75835	Borsod	Déta, Korcs	1342	4 February	great flood	Szinva
20	DL 58509	Bács	Aranyan	1342	a day between 11 April and 7 May	floods	Danube (??)
21	AO 4/289	Bars	Besenyő	1342	25 April	inundation of waters	Zsitva
22	AO 4/284	Pozsony	Báhony, Zámoly	1342	15 September	hard times, deep snow	-
23	DL 68845	Sáros	Tarkő, Lucska, Haruncsár	1342	5 day between 21 July and 19 August	strong frost, cold weather	-
24	AO 5/68	Baranya	Vaiszló, Hirics, Luszok	1342	15 September	flood	small tributaries of the Dráva
25	AO 4/280	Zemplén	Maráza	1342	11 November	inundation of waters	Tapoly and Ondava
26	Zichy 2/58		Zámmonostor	Before 1343	-	probable floods of the previous times	Hortobágy
27	AO 4/341	Heves-újvár	Kömlő	1343	15 May	flood and hard times	Tisza
28	DL 96237	Borsod, Zemplén	Szentalbert, Kerencs	1343	13 July	flood	Sajó
29	Zichy 2/127, 130, 148		Bazza	1344		swampy, inundated land	meeler stream: in the forest of the Bodrog
30	Károlyi 1/164	Hevesúj-vár	Poroszló, Megyer	1346	20 April	great flood	Tisza (Egervize)

number of data	source	county	place	year	month, day	event	floods of rivers
31	DL 3794		Felk	1346		previous floods	Danube (??)
32	AO 5/119	Borsod	Ónod, Hidvég	1347	23 February	great floods of waters	near the Sajó
33	DL 30383	Küküllő	Dombó	1348	19 October	flood	Kis-Küküllő
34	AO 5/266	Szatmár, Bereg	Badaló, Kér	1349	13 January and the following days	floods of waters	near the Tisza and Szamos
35	AO 5/271	Gömör	Panyit	1349		too wet and swampy area	
36	Anony-mous Minorite 107		Northeastern Carpathians	1352	4 (?) days before 6(?) April	deep snow reaching the saddle of the horses	-
37	AO 6/527	Ungvár	Sislóc	1356	7 December	too great flood	Ung
38	Zichy 3/61, 67, 93, 128	Ungvár	Daróc	1357	1 May	too great inundations of waters	Ung
39	AO 7/16-9	Hont	Tarcsány	1358	20 January	winter weather, frozen ground	-
40	DL 90540	Turóc	between Nadasér and Polereka	1361	10 March	deep snow	-
41	DF 266 606	Tolna, Somogy	Tamási, Hedruh (Hedrehely)	1364	a day between 8 January and 9 February	severe winter, deep snow	-
42	Fejér 9/3/408		Hungary	1364		high prices	-
43	DL 58575	Bodrog	Csente	1366	a day between 18 March and 12 April	floods	near the Danube (??)
44	ZW 897/293	?	?	1367	13 January	flood	the catchment area of river Maros (??)

number of data	source	county	place	year	month, day	event	floods of rivers
45	DL 96425	?	Hosszúmező	1367	1 May	great flood of the waters	Tisza and its tributaries
46	DL 36825	Békés (?)	Belmeger	before 1367 (years)	-	frozen lakes	
47	DL 30706, DL 31105, DL 30398	Alsó-Fehér	Gyógy, Orbó, Enyed	1372	May	sudden rain(s), bad weather	-
48	Károly 2/682	Fejér	Sárszabadi, Székesfehérvár	1372	28 June	inundation of waters	swamps of the Sárrét area, Sár river (?)
49	DL 106183	Fejér	Halász	1377	1 July	flood	Danube
50	DL 96560	Zemplén	Rozvág, Cigánd	1381 (?)	6 (?) March	flood, bad weather	Tisza

NOTES TO THE QUESTION OF LOCALISATION

Due to the changes of the early 20th century, many of the places, mentioned in *Table 1*, can be found today in the neighbouring countries. Because of this, it is also important to give the present names of these settlements (if they exist):

Croatia:
15. Eszék = Osijek

Romania:
33. Dombó = Dâmbau
47. Gyógy = Stremt, Orbó = Gârbova de jos, Enyed = Aiud

Slovakia:
1. Garamszentbenedek = Hronský Benadik, Lehotka = Lehota
2. Szepesség = Spiš region
5. Pécs-Újfalu = Pecovská Nová Ves
9. Szántó = Sántov
10. Tasolya = Tašul'a, Pálóc = Pavlovce nad Uhom
14. Trócsány = Trocany

16. Csoltó = Coltovo, Lekenye = Lekena
17. Páka = the area of the present Vel'ká Paka
18. Harmac = Hrmavec
21. Besenyő = Bešenov
22. Báhony = Báhon, Zámoly = abandoned land near Báhon
23. Tarkő = Kamenica, Lucska and Haruncsár - abandoned settlements near Kamenica
35. Panyit = Poniata
39. Tarcsány = Horné-Semerovce
40. Nadasér = Nedozor - today it is part of Rakša, Polereka = Polerieka

Ukraine:
11. Szelmenc = Solonci - today it is part of Komarovci
34. Badaló = Badolovó
37. Sislóc = Sislovci - today it is part of Tarnovci
38. Daróc = Dravci - today it is part of Uzshorod

Yugoslavia:
20. Aranyan = abandoned land northwest to Petrovaradin

ABBREVIATIONS OF PRIMARY SOURCES

Anonymous Minorite: *Geréb, I. and Trencséni-Waldapfel, I.,* 1960: *The chronicle of the Anonymus Minorite and János Küküllei*. Budapest.
AO: *Nagy, I. and Tasnádi Nagy, Gy.,* 1878-1920: *Codex diplomatarium Hungaricum Andegavensis*. 7 Vols. (in Hungarian) Budapest.
AOklt. 2: *Kristó, Gy.,* 1992: *Cartulary of the Angevin Period: 1306-1310* (in Hungarian). Vol. 7. Budapest-Szeged.
AOklt. 7: *Blazovich, L. and Géczi, L.,* 1991: *Cartulary of the Angevin Period: 1339* (in Hungarian). Vol. 7. Szeged.
Anjou Oklt. 12: *Almási, T.*: *Cartulary of the Angevin Period: 1328* (in Hungarian). Vol. 12. Szeged. Manuscript
AOklt. 23: *Piti, F.*, 1999: *Cartulary of the Angevin Period: 1339* (in Hungarian). Vol. 23. Szeged.
Bgl.: *Lindeck-Pozza, I.*, 1985: *Urkundenbuch des Burgenlandes und der angrenzenden Gebiete der Komitate Wieselburg, Ödenburg und Eisenburg. Die Urkunden von 1328 bis 1342 mit Nachträgen von 1284 bis 1318.* Vol. 4. Vienna.
Chron. Aulae Regiae: Chronicon Aulae Regiae Lib. I. Abbati Ottonis et Petri de Zittau. Ed.: Fontes Rerum Bohemicarum. Praha, 1873.
Chron. Leobiensis: *Zahn, J.,* 1889: Chronicon Leobiensis.

DL, DF: Archives of Diplomatics (Hungarian National Archives, Collection of medieval charters)
Fejér: *Fejér, Gy.,* 1829-1844: *Codex Diplomaticus Hungariae ecclesiasticus ac civilis*. Budae
G. Hain Chr.: *Véber, K. (ed.),* 1988*: Chronicle and annales of the Szepesség and Lőcse for the kind posterity by Gaspar Hain.* (in Hungarian) Budapest.
Károly: *Károly, J*., 1898: *History of Fejér county*. Vol. 2. Székesfehérvár
Károlyi: *Géresi, K.,* 1882-1897: *Codex diplomaticus comitum Károlyi de Nagykároly*. 5 Vols. Budapest.
Kub.: *Kubinyi, F*., 1888: Diplomatarium Hontense. Vol. 1. In*: Monumenta Hungariae Historica* II. Budapest.
Schmauk: *Schmauk, M.,* 1889: *Supplementum Analectorum terrae Scepusiensis*. Pars II. Szepesváralja.
Wenzel: *Wenzel, G.,* 1871-1876*: Acta extera Andegavensia*. Vol. 1-3. Budapest.
Zala: *Nagy, I. and Véghelyi, D*., 1886-1890: *The history of Zala county. Chartulary*. 2 Vols. (in Hungarian). Budapest.
Zichy: *Nagy, I., Nagy, I. and Véghely, D*., 1871-1931*: Codex diplomaticus domus senioris comitum Zichy de Zich et Vásonkeő* I-XII. Pest-Budapest.
Z.W.: *Zimmermann, F., Werner, C. and Müller, G*., 1892-1981: *Urkundenbuch zur Geschichte der Deutschen in Siebenbürgen*. I-VI. Hermannstadt-Köln-Wien-Bukarest.

REFERENCES

Alexandre, P., 1987: *Le climat en Europe au Moyen Age. Contribution a l'historie des variations climatiques de 1000 a 1425, d'apres les sources narratives de l'Europe occidentale.* Ecole des Hautes Etudes en Sciences Sociales, Paris.
Borisenkov, E. P. and Paseckij, V. M., 1983: *Ekstremalnyje prirodnye javlenija v rzsskih letopisjah XI-XVII vv*. Leningrad.
Brazdil, R. and Kotyza, O., 1995: *History of Weather and the Climate In the Czech Lands I. Period 1000-1500*. Geographisches Institut ETH, Zürich.
Chernavskaya, M., 1992: *Botanical indicators of the Little Ice Age in the Russian Plain. In: Proceedings of the International Symposium on the Little Ice Age Climate*. Tokio.
Kiss, A., 1996: Some weather events from the fourteenth century (1338-1358). *Acta Climatologica Universitatis Szegediensis 30*, 61-9.
Kristó Gy., 1988: *Wars of the Angevin Period* (in Hungarian). Budapest.
Lamb, H. H., 1982, 1995: *Climate, history and the Modern World*. London.
Lamb, H. H., 1988: *Weather, climate and human affairs*. London.

Pfister, C., Schwarz, G. and Wegmann, M. 1996: Winter severity in Europe: the fourteenth century. *Climate Change 34*, 91-108.

Ságí, K., 1968: The waterlevel tendencies of Lake Balaton in the mirror of the historical and cartographical data (in Hungarian). *Veszprém Megyei Múzeumi Közlemények 7*, 441-468.