Europe around the year 1000, ed. P. Urbańczyk
Warsaw 2001, 101–107

WOOD AND CLIMATE OF THE YEAR 1000 A.D.

Tomasz Ważny*

Historical events were usually related to the climate and natural events. So let us look at the world of plants in the year 1000 A.D. and get some information from this objective source.

Trees systematically register the history of climate in their annual rings, which are produced during the vegetative period. Single annual rings consist of porous earlywood formed in spring and more compact latewood formed in summer (Fig. 1). The strength of relationship between tree–rings and climate depends on the species and its genetic preferences. Studies of those relationships and reconstruction of climate are the objects of dendroclimatology — one of the most important subfields of dendrochronology.

The wood that grew exactly in 1000 can be located in two possible ways: by studying trees which are over 1000 years old or by analysing wood used in the construction of historical objects, or from subfossil trunks. The first kind of study material, trees over a millennium of age does not exist in Europe with only few exceptions but dendrochronological studies which are made in North America and Southern Hemisphere are based on such ancient but still living trees. An allocation of growth rings to the corresponding calendar years needs to be matched to a master chronology for the proper species of wood. The master chronology is a continuation of records of the modern tree established, by the overlapping older ring patterns.

A schematic presentation of this method is shown in Fig. 2. The year 1000 has been shown against the background of a longer time axis — from 950 to 1050. This can illustrate the nature of the year 1000 for trees. At the same time there is information about climate. The information of the International Tree Ring Data Bank (ITRDB) collected in the World Data Center–A for Paleoclimatology (WDC–A) were the main sources for the following analysis supplemented by the author's data.

SOUTHERN HEMISPHERE

The data for this part of the world are very poor because only two time series coming from ITRDB reach the year 1000. One was made for Tasmania and the second for Argentina.

* Academy of Fine Arts, Warsaw, Poland.

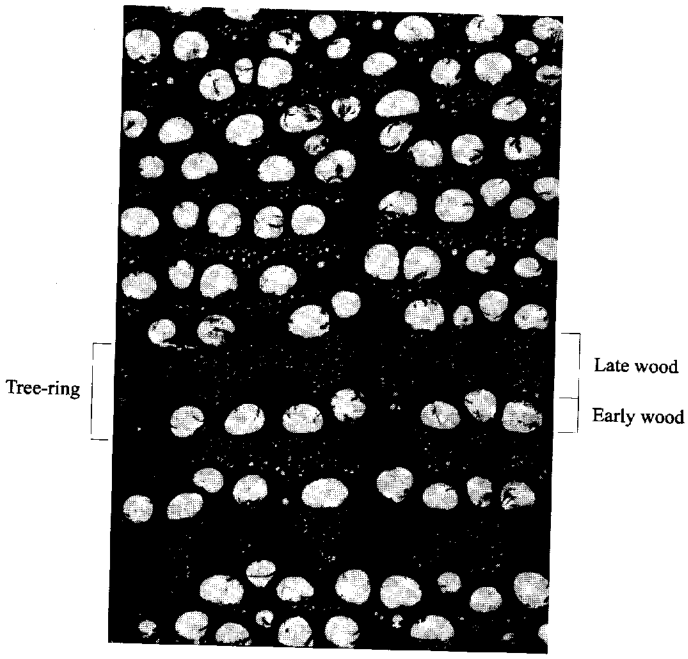

Fig. 1. Cross section of oak. Band of large early wood vessels is easy to distinguish from the late wood

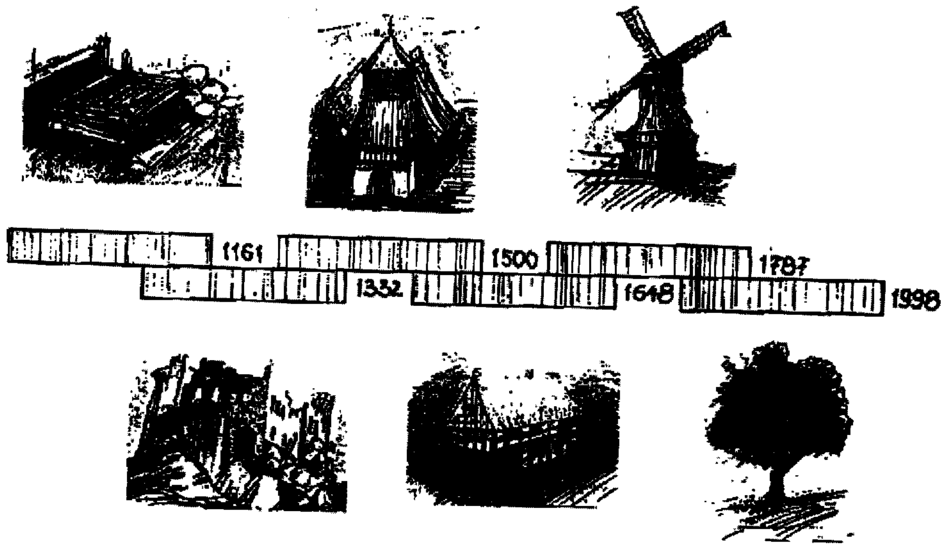

Fig. 2. Principle of chronology development

Data from Tasmania are based on research on Huon Pine trees (*Lagarostrobos franklini* C.J. Quinn,) which grow on Mount Read in the western part of the island. Subfossil logs allowed this sequence to be continued back to 300 B.C.[1] The reconstructed past temperature change is representative for wide part of Southern Hemisphere — from Australia to New Zealand.

A part of the time series, which includes years 950–1050 is shown in Fig. 3. The average temperatures of the warm season in the year 1000 was much lower than the

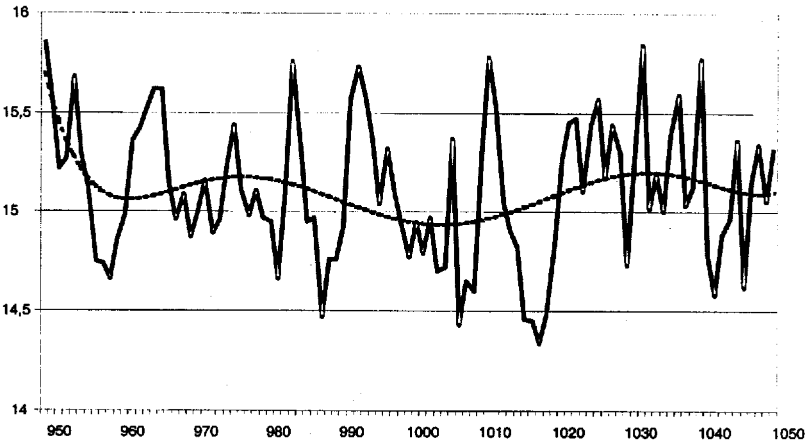

Fig. 3. Tasmania temperature reconstruction for warm season (E.R. Cook et al. 1995). Dashed line shows long–term trend

average value compared with the temperature of the previous and following year. Year 1000 started a cooler decade, but distinct cooling down is indicated only for the years 1014–1020.

Boninsegna[2] constructed the chronology of Patagonian cypress (*Fitzroya cupressoides* Molina Johnson). Those trees grew slower in 1000 than in the preceding and following years, but the significant minimum of growth happened in the year 1007 (Fig. 4). Narrow ring widths result from low temperature conditions in this part of South America and confirm that the year 1000 was cooler in the Southern Hemisphere.

ASIA

The Asiatic continent is an area with few tree–ring chronologies longer than 1000 years back. In the beginning dendrochronological studies were concentrated at the

---

[1] E.R. Cook et al. 1995.
[2] J. Boninsegna 1996.

Rio Cisne, Argentina

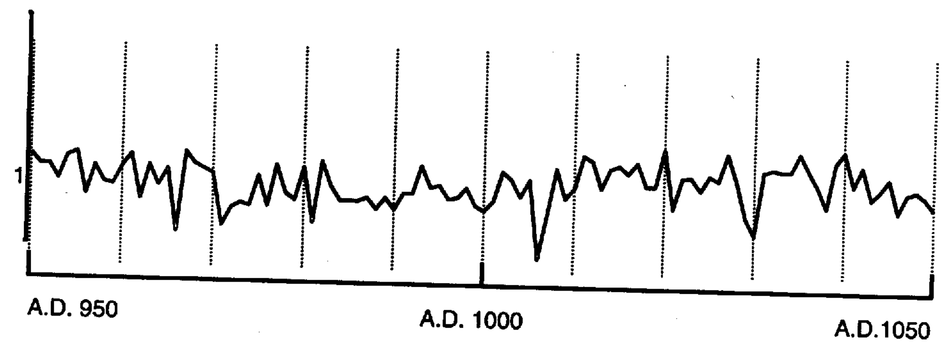

Fig. 4. Ring–widht index chronology from 950–1050 A.D. of patagonian cypress (J. Boninsegna 1996)

Siberian Plateau along northern timberline, but in 1990s also spread in the high mountain areas of Central Asia: Karakorum[3] and Tibet[4].

In the severe high mountain conditions, the juniper lives especially long, and Bräuning[5] has constructed a chronology covering the years 449–1994 A.D. for the trees of this species which grow in Quamdo — in the western part of the Tibetan Plateau. The period of 950–1050 (Fig. 5) we may observe a remarkable deep and rapid growth

Qamdo, Tibet

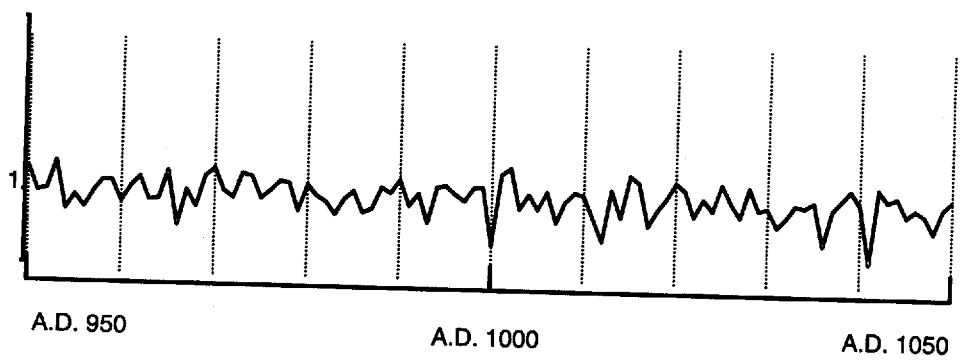

Fig. 5. Ring–width index chronology from 950–1050 A.D. of Juniperus (A. Bräuning 1999)

reduction of those trees exactly in the year 1000. The ring width index felt down near 50% and it was the deepest growth reduction during the whole period. In the next two

[3] J. Esper 2000.
[4] A. Bräuning 1999.
[5] A. Bräuning 1999.

years, the trees showed clear signs of recovery after such an unfavourable weather. Unfortunately, from the climatological point of view, unambiguous interpretation of the obtained results is impossible. Juniperus trees growing in such an arid area as the Quamdo region responded positively to spring and early summer precipitation[6]. On the other hand, those trees grow at a height of 4350 m with extremely strong solar radiation.

EUROPE

The main species in European dendrochronology is oak. The oldest living oak trees only sometimes reach the age of 400 years, but the oak timber always was a very valuable material used for constructions. Apart from this, deposits of subfossil oak trees lie in peat and valleys of European rivers. That is the reason why the longest tree–ring chronology in the world has been established exactly for Central European oak and reaches back to 8480 years B.C.[7]

In European tree–ring patterns, the year 1000 A.D. is not so distinctive as in other continents. It was a little worse year for trees than the previous and next years. In the zone between France, Holland, Germany and Poland the oak's tree rings in 999 and 1001 A.D. were about 10–15% wider than in the year 1000. This slight decrease of 1000 didn't transgress the borders of natural variability of tree–ring widths from the point of view of 950–1050 years. A typical illustration of central European wood formed in 1000 A.D. is shown in Fig. 6. The annual band of wood from Scandinavia and England formed in the same year is not distinguished by anything special. In Ireland ring patterns obtained from archaeological material looked more favourable for trees than adjoining years. Those regional differences however were not a result of climate differentiation in Europe 1000. In fact British oak trees mostly react to temperature and moving to the east with increasing continental influence on climate. We can observe the increasing response of precipitation of the vegetation period on trees.

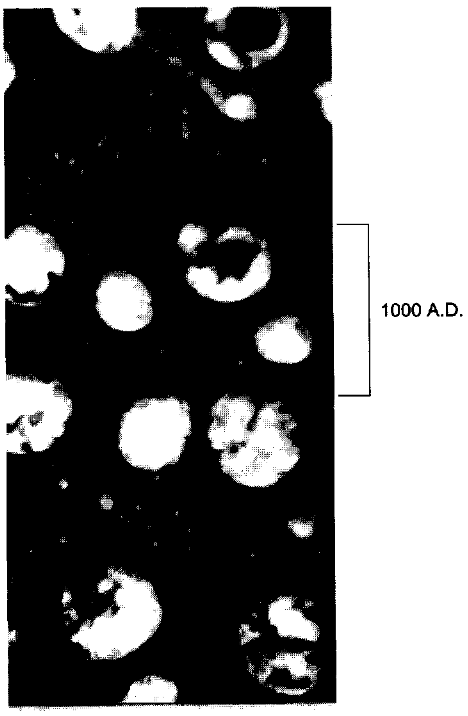

Fig. 6. Wood of the year 1000 A.D. formed by oak growing in NW Poland and found in medieval building phase of Szczecin

[6] A. Bräuning 1999.
[7] M. Spurk et al. 1998.

Another valuable source of data in Europe is pine trees growing near the northern border of their existence in Scandinavia. Detailed data for those tree–ring chronologies have not been published yet.

NORTH AMERICA

North America is characterised by substantial climate differentiation and, at the same time, by conditions which allow trees reach a huge size and an age of thousands years. Climatic differentiation means that different trees had varied reaction to the conditions in 1000 A.D. Of course of most interest was to examine how the oldest trees in the world — the Bristlecone Pine (*Pinus longaeva* D.K. Bailey) — behaved in the years discussed here. Bristlecone Pine can reach an age over 4000 year and these trees are the oldest living organisms in the world, (and not Giant Sequoia as in popular opinion). Bristlecone Pine appears in The White Mountains in California at a height of 3000 m. In those conditions the length of the vegetation period is about 6 weeks and this is the only time for formation a new xylem layer for trees. Their huge vital strength allows them to live in extreme arid and cold conditions. The turn of the first and second millennium A.D. seemed to be favourable for those trees although 5 years later it was bad for them and in the worst year, 995 A.D. an average annual ring of analysed trees reached only 0,01 mm. For Whitebark Pine (*Pinus albicaulis* Engelm.) growing in the Yosemite National Park in California, the year 1000 was favourable too.

We see a similar reaction among the trees in the east part of North American continent. Weymouth Pine (*Pinus strobus* L.) from Ontario in Canada registered slight growth reduction although significant reduction of annual rings appeared in Bald Cypress (*Taxodium distichum* (L.) Rich.) from Georgia and North Carolina (Fig. 7).

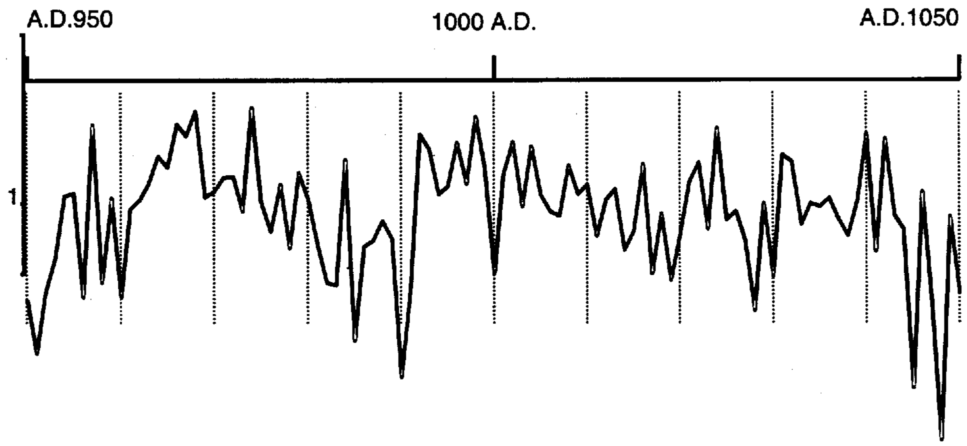

Fig. 7. Ring–width index chronology from 950–1050 A.D. of baldcypress (after D. W. Stahle et al. 1996)

*

To summarise the information from all continents except Antarctica about the wood of the year 1000 A.D., we have to admit that it was in general an unfavourable period. Because trees mainly react to climatic conditions it is possible to conclude that the mentioned year had worse conditions than the previous and the next year. It should be remembered that we are talking of the period of the Medieval Warm Epoch — a significant warmer time with possible problems with water supply. Further more detailed conclusions considering the climate of the period requires detailed analyses of wood from the 10th and 11th centuries and to supplement it with more complete information from other sources of climatic information (ice cores, pollens, corals etc.).

The information about climate written by tree growth is a more objective and authentic record than the information from chronicles, where heavy local rainfall looked like a catastrophic wet summer and three days of freeze seemed to be extremely cold winter. In the case of this special date of the year 1000, the analysis of the wood from that year was a good opportunity to look at the organic material precisely dated and distinguished from 999 and 1001 A.D. There are only few cultural remains about which we can state with real certainty that they originated exactly from 1000 A.D. The dendrochronological analyse of wood and timbers make this possible.

REFERENCES

Boninsegna J.
1996 *Rio Cisne Tree Ring Record,* [in:] H.D. Grissino–Mayer, H.C. Fritts (eds), International Tree–Ring Data Bank. IGBP PAGES/World Data Center–A for Paleoclimatology Data. NOAA/NGDC Paleoclimatology Program, Boulder Co., USA.

Bräuning A.
1999 *Zur Dendroklimatologie Hochtibets während des letzten Jahrtausends*, Berlin––Stuttgart.

Cook E.R., Buckley B.M., D'Arrigo R.D.
1995 *Interdecanal temperature oscillations in the Southern Hemisphere: Evidence from Tasmanian tree–rings since 300 B.C. Natural Climate Variability on Decade––to–Century Time Scales*, National Research Council: 523–531.

Esper J.
2000 *Long–term tree–ring variations in Juniperus at the upper timberline in the Karakorum (Pakistan)*, „The Holocene" 10: 253–260.

Spurk M., Friedrich M., Hoffmann J., Remmele S., Frenzel B., Leuschner H.H., Kromer B.
1998 *Revisions and extensions of the Hohenheim oak and pine chronologies — new evidence about the timing of the younger Dryas/Preboreal–transition*, „Radiocarbon" 40.

Stahle D.W., Cleaveland M.K., Hehr J.G.
1996 *Black River Tree Ring Record*, [in:] H.D. Grissino and H.C. Fritts (eds), International Tree Ring Data Bank. IGBN PAGES/World Data Center–A for Paleoclimatology Data. NOAA/NGDC Paleoclimatology Program Boulder CO, USA.