International symposium

Wood Science and Craftsmanship

WoodSciCraft

8-12 September 2014

-Montpellier, France-

-Book of Abstracts-

Edited by

Pierre Cabrolier and Iris Brémaud

Printed for Equipe **BOIS, LMGC**
(UMR 5508, CNRS, UM2)
by **AVL Diffusion** (Montpellier)
-September 2014-

FOREWORD

WoodSciCraft 2014 aims to create a gathering between wood scientists and wood craftsmen for a cross-perspective on the cultural and natural heritage of wood uses in Europe and Japan.

The central objective of this symposium is to create positive grounds for profound mutual exchanges between these two expert communities: wood scientists study wood, while wood craftsmen know wood, and these two communities and viewpoints shall collaborate if a better understanding of wood utilisation is sought after.

The symposium *WoodSciCraft* is centered around 4 woodworking specialties, were difference academic themes interfere.
Each day will focus on one craft specialty:

- *(Day1)* Wood building and carpentry
- *(Day2)* Cabinet making and woodturning
- *(Day3)* Musical instruments making
- *(Day4)* Traditional treatments, finishing, varnish and lacquer.

The 4 academic themes that will interact for each day are:

- Wood uses throughout cultures *(ethnobotany, history of techniques, interaction between cultural and physical studies)*
- Wood in time *(ageing, time-, temperature- and humidity- dependant behaviour)*
- Diversity and variability of wood and its properties *(anatomy, structure-chemistry-properties relationships, from between species to within-tree)*
- Relation between wood and its users *(perception, exploring "new" species, socio-environmental aspects of wood uses)*

Préface

WoodSciCraft 2014

WoodSciCraft 2014 committees

Symposium Chairwoman:

Iris Brémaud (LMGC Lab., Montpellier, France)

Symposium Vice-chairman:

Pierre Cabrolier (LMGC Lab., Montpellier, France)

Scientific committee:

- Jacques Beauchêne (Ecologie des Forêts de Guyane, Kourou, French Guiana)
- Iris Brémaud (Lab. de Mécanique et Génie Civil, Montpellier, France)
- Joseph Gril (Lab. de Mécanique et Génie Civil, Montpellier, France)
- Catherine Lavier (Lab. d'Archéologie Moléculaire et Structurale, Paris, France)
- Naoko Matsuyama (Dpt. of Intangible Cultural Heritage, Tokyo, Japan)
- Mechtild Mertz (Ctr. de Recherche sur les Civilisations de l'Asie Orientale, Paris, France)
- Eiichi Obataya (Lab. of Wood Science and Technology, Tsukuba, Japan)
- Nelly Poidevin (Bow maker, Dinan, France)
- Hiroyuki Yamamoto (Lab. of Bio-Material Physics, Nagoya, Japan)
- Misao Yokoyama (Lab. of Biomaterials Design, Kyoto, Japan)

Local organizing committee:

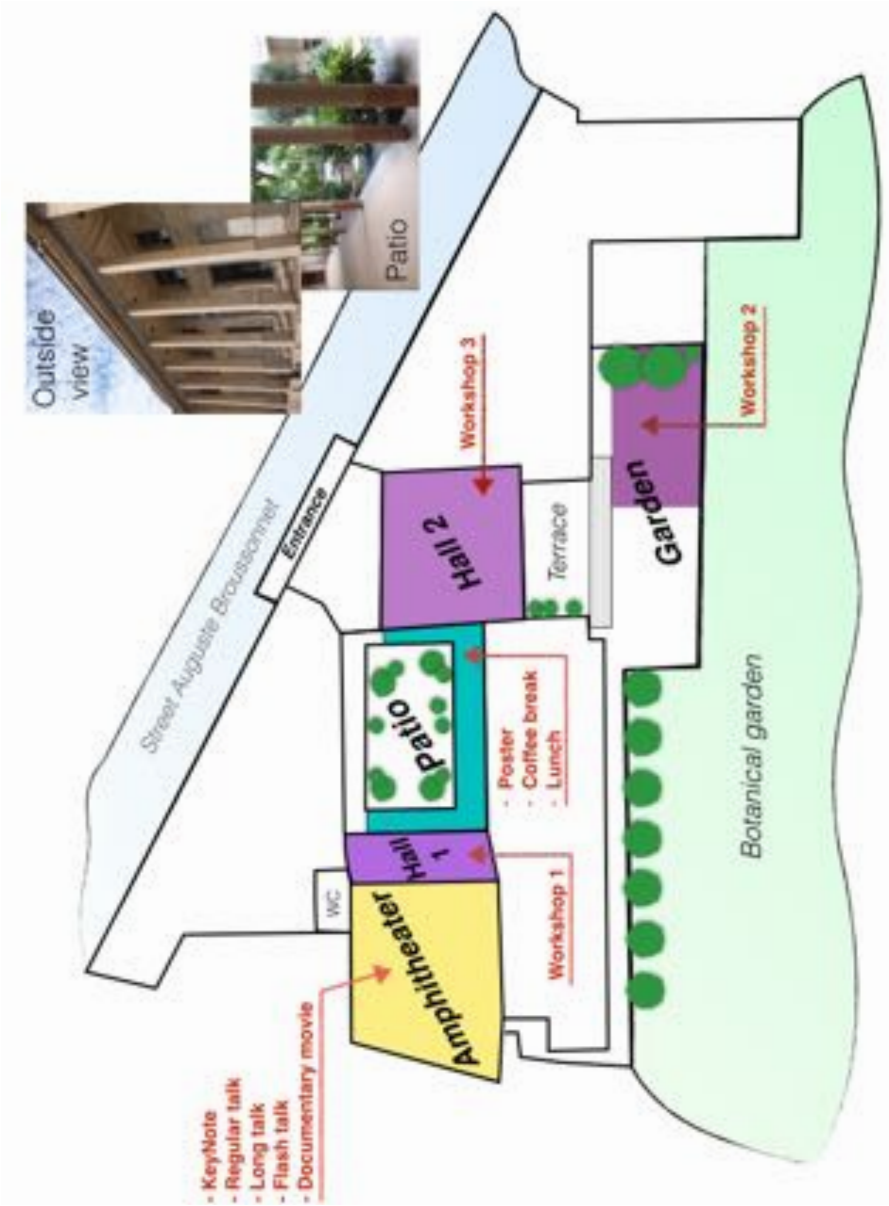
- Bardet Sandrine (LMGC, Montpellier, France
- Iris Brémaud (LMGC, Montpellier, France)
- Pierre Cabrolier (LMGC, Montpellier, France)
- Roxane Crémer (LMGC, Montpellier, France)
- Jean Gérard (CIRAD-BioWooEB, Montpellier, France)
- Nicolas Gilles (Violin maker, Montpellier, France)
- Joseph Gril (LMGC, Montpellier, France)
- Michèle Lagacherie (CRPF-LR, Montpellier, France)
- Chantal Romano (LMGC, Montpellier, France)
- Kheira Sahli (LMGC, Montpellier, France)

Official sponsors:

Scientific partners:

Map of the Botanical Institute

163 Rue Auguste Broussonnet
34090 Montpellier



WEEK PROGRAM

Time	Monday 8 *Wood in Structure, building and carpentry*	Tuesday 9 *Cabinet making and woodturning*	Wednesday 10 *Musical instrument making (Joint event with COST FP1302)*	Thursday 11 *Wood treatments, finishing, varnishes and lacquer*
07:45	Registration and coffee			
08:00		Registration and coffee	Registration and coffee	Registration and coffee
08:15				
08:30				
08:45	Welcoming speech		Introduction & Welcome COST	
09:00	Introduction	Introduction	Session 1: KeyNote 1	Introduction
09:15	Session 1: KeyNote 1	Session 1: KeyNote 1		Session 1: KeyNote 1
09:30				
09:45			KeyNote 2	
10:00	Regular talks (x3)	Regular talks (x3)		Regular talks (x3)
10:15			Regular talks (x2)	
10:30				
10:45	FlashTalks (x3)	FlashTalks (x4)	FlashTalk (x4)	FlashTalk (x2)
11:00	Coffee break & Poster Session	Coffee break & Poster Session	Coffee break & Poster Session	Coffee break & Poster Session
11:15				Session 2: Long talk
11:30	Session 2: KeyNote 2	Session 2: KeyNote 2	Session 2: Long talk	
11:45				Regular talk (x1)
12:00			Regular talks (x4)	Workshop session I
12:15	Regular talks (x3)	Regular talks (x3)		
12:30				
12:45				
13:00	Lunch time	Lunch time	Lunch time	Lunch time
13:15				
13:30				
13:45				
14:00				
14:15				
14:30	Long talk	Long talk	Workshop session I	Workshop session II
14:45				
15:00				
15:15	Workshop session I	Workshop session I		
15:30			Coffee break	Round table and conclusion
15:45			Workshop session II	
16:00				
16:15	Coffee break	Coffee break		
16:30				Laboratory visits
16:45	Workshop session II	Workshop session II		
17:00			Session 3: Regular talks (x3)	
17:15				
17:30				
17:45	Round tables	Round tables	Round tables	
18:00				
18:15				
18:30				
18:45				
19:00			Gala dinner + Concert	Musical event

Friday 12

Technical visit (historical center and workshop)

Daily program

MONDAY 8th of September

- Wood in structure, building and carpentry -

07:45 08:45	*Welcome and coffee*		
08:45 09:00	Welcoming speech from the official institutions		
09:00 09:20	Introduction speech (English, Japanese, French)		
09:20 10:05	KeyNote 1	François Calame	Pre Industrial Timber Framing
10:05 10:20	Regular talk 1	Sebastian Nemestothy & al.	Analyzing an austrian Farm house – dating, wood species and wood quality
10:20 10:35	Regular talk 2	Clémence Ogéron & al.	Local knowledge about uses and technological properties of construction timber of Bas-Oyapock (French Guiana)
10:35 10:50	Regular talk 3	Lisa Shindo & al.	Dendrochrono-ecological and archaeological study of traditional buildings in the southern French alps
10:50 10:55	FlashTalks	Catherine Lavier (1)	
10:55 11:30	*Coffee break & Poster Session & Photography exhibition (2)*		
11:30 12:15	KeyNote 2	Hiroyuki Yamamoto	Internal stress and dimensional instability of wood - a scientist's view
12:15 12:30	Regular talk 4	Cédric Montéro	Wood hygromechanics for structural timber building longevity
12:30 12:45	Regular talk 5	Mariko Yamasaki & al.	Mechanical condition of wood member in the Japanese traditional building
12:45 13:00	Regular talk 6	Gerold Esser & al.	The historic roof structures of the vienna hofburg. An innovative interdisciplinary approach between architecture and structural engineering sciences
13:00 14:30	*Lunch time*		
14:30 15:15	Long talk	Mathieu Peeters	Japanese Roof Geometry
15:15 15:45	Workshop I (3)	(Group1): Masaki Tatenaka - (Group2): Florian Carpentier	
15:45 16:15		(Group1): Florian Carpentier - (Group2): Masaki Tatenaka	
16:15 16:45	*Coffee break*		
16:45 17:45	Workshop II (3)	Benoît Dubost ; Florian Carpentier ; Masaki Tatenaka	
17:45 18:30	Round tables and discussions		

(1) Poster:

- Jean-S. Cluzel & **Catherine Lavier**: Akhan project: Albert Kahn, Archaeology of a Nippon heritage

(2) Photography exhibition:
A selection of photography will by exposed. They have been taking by Jeremy Brodbeck (French carpenter) about the partial reconstruction of a part of the roof at the Château de Gaillon (realized by the group « charpentiers sans frontières » initiated by François Calame).

(3): Workshop session I and II:

- **Florian Carpentier,** French carpenter: (**Group1**) Dismantling, restoration, reassembly of a timbered sheepfold of the 18th century, from the baie de Somme (France) ; (**Group2**) Restoration of the frontage of a timbered manor from the 16th century, in Hebécourt (France).

- **Masaki Tatenaka,** Japanese carpenter **(Group1 and 2)**, title: Japanese carpentry and Sukiya-Tea House - Assembly of round wood

- **Benoît Dubost** (French carpenter) and **Florian Carpentier**, title: Demonstration of traditional beam squaring

TUESDAY 9th of September

- CABINET MAKING AND WOODTURNING -

08:00 09:00	*Welcome and coffee*		
09:00 09:15	Introduction speech (English, Japanese, French)		
09:15 10:00	KeyNote 1	Mechtild Mertz	The wood species in Japanese craft and carpentry
10:00 10:15	Regular talk 1	Naoko Matsuyama	Safeguarding traditional craftsmanship as intangible heritage of Japan
10:15 10:30	Regular talk 2	Catherine Lavier & al.	Archeodendrometrical approaches of a Shinto-Buddhist sulpture
10:30 10:45	Regular talk 3	Magali Toriti & al.	The condition of wood worked of antiquity: archeological, entomological and anthropological approches
10:45 11:05	FlashTalks	Friederike Saxe (1) ; Nills Horbelt (1) ; Siham Amirou (1) ; Nima Saedlou (1)	
11:05 11:35	*Coffee break & Poster Session*		
11:35 12:20	KeyNote 2	Patrick Perré	Wood drying fundamentals and trade-offs
12:20 12:35	Regular talk 4	Aoi Hirano & al.	Development of flexible wooden composite using compressed wood
12:35 12:50	Regular talk 5	Misao Yokoyama	(How to evaluate Japanese traditional wisdom in wood working)
12:50 14:25	*Lunch time*		
14:25 15:10	Long talk	Alain Mailland	Artistic woodturning/sculpture from Mediterranean green wood
15:10 15:40	Workshop I (2)	(Group1): Kenichiro Yano - (Group2) Sara Robinson - (Group2): Bernard Azema	
15:40 16:10	Workshop I (2)	(Group1): Hiroyuki Ayabe - (Group2): Kenichiro Yano - (Group3): Ryosaku Takeda	
16:10 16:45	*Coffee break*		
16:45 17:15	Workshop II (2)	(Group1): Bernard Azema - (Group2): Hiroyuki Ayabe - (Group3): Kenhichiro Yano	
17:15 17:45	Workshop II (2)	(Group1 & 2): Ryosaku Takeda - (Group3): Sara Robinson	
17:45 18:30	Round tables and discussions		

(1) Poster:

- Friederike Saxe & al.: Mining historical literature, objects and practices
- Nils Horbelt & al.: The combined influence of varying microfibril angle and moisture content on the tensile stiffness of single spruce fibres
- Siham Amirou & al.: Bio-particleboards from date palm trunk

- Nima Saedlou: Use and woodcraft in the iron age time through an unusual corpus of Trégueux (Côte d'Armor)

(2): Workshop session I & II:

- Ryosaku Takeda (Japanese Professor of fine cabinet making), title: « wood in Japanese Folk Art »

- Yano KenIchiro (Japanese Professor and restorer of Japanese sculpture), title: « Demonstration of Camelia flower made by sculpting and plane shavings »

- Hiroyuki Ayabe (expert Japanese woodturner), title: « Exhibition of wood blanks and turned pieces, and discussion of the place of wood figures in Japanese esthetics »

- Sara Robinson (American Assistant Professor in Anatomy of renewable materials, expert on woodturning and spalted wood), title: « Demonstration/exhibition of woodturning using spalted wood »

- Bernard Azema (French carpentry/joinery teacher and passionate for woodturning), title: « Woodturning of very fine imbricated pieces called slender turning (or trembler) »

WEDNESDAY 10th of September

- Musical instruments making -

Joint event with focused meeting of COST action FP1302 WoodMusICK (http://woodmusick.org/)

08:00 08:45	*Welcome and coffee*		
08:45 08:55	Introduction speech (English, Japanese, French)		
08:55 09:00	Welcome and introduction speech for COST WoodMusICK by Sandie Le Conte		
09:00 09:40	KeyNote 1	David Van Edwards	The Wooden Economy - Logistics solutions for Lutemakers
09:40 10:20	KeyNote 2	Kiyoko Motegi	The "sound of wood" in Japanese traditional music instruments and soundscape
10:20 10:35	Regular talk 1	Nelly Poidevin	Wood diversity in bow making
10:35 10:50	Regular talk 2	Aida Se Golpaygani & al.	Traditional grading and treatment for Juglans regia and Morus alba used in Iranian musical instruments
10:50 11:05	FlashTalks	Connor Kemp (1) ; Capucine Carlier (1) ; Ferina Saati Khosroshahi (1)	
11:05 11:35	*Coffee break & Poster Session*		
11:35 12:05	Long talk	Iris Brémaud	Wood mechanics viewpoint on biological and cultural diversity of instrument making woods
12:05 12:20	Regular talk 3	David Hunt	Slow changes in wood properties with time, stress and environment
12:20 12:35	Regular talk 4	Sandie Le Conte & al.	Influence of wood porosity on wind instruments
12:35 12:50	Regular talk 5	Arthur Paté & al.	The wood of the Electric guitar: A mechanical and perceptual description
12:50 13:05	Regular talk 6	Alès Straze & al.	Assessment of moisture-dependent vibrational properties of rosewood
13:05 14:30	*Lunch time*		
14:30 15:00	Workshop I (2)	(Group1): Ishida - (Group2): Gil de Avalle - (Group3): Salenson	
15:00 15:30	Workshop I (2)	(Group1): Zare Mohazabiyeh - (Group2): Michaud - (Group3): Poidevin	
15:30 16:00	*Coffee break*		
16:00 16:30	Workshop II (2)	(Group1): Poidevin - (Group2): Ishida - (Group3): Gil de Avalle	
16:30 17:00	Workshop II ()	(Group1): Michaud - (Group2): Salenson - (Group3): Zare Mohazabiyeh	
17:00 17:15	Regular talk 7	Marco Fioravanti	Technological analysis of early wooden musical instruments: a contribute to the definition of traditional knowledge systems

17:15 17:25	Regular talk 9	Naoko Matsuyama	Introduction on Japanese system of ICH (Intangible Cultural Heritage)
17:25 18:30	Round tables and discussions		
19:00 00:45	*Gala dinner (FULL) + concert of Tornamai (3)*		

(1) Poster:

- Connor Kemp & al.: Observing stiffness variability in reed cane (Arundo donax) and the resulting vibrational response using finite element modeling
- Capucine Carlier & al., title: « Characteristics of "resonance wood" as viewed by violin makers or by wood scientists »
- Ferina Saati Khoscroshahi & al.: Modal Analysis of the Tar Resonance Box Using Finite Element Method

(2): Workshop session I & II

- Daniel Gil de Avalle (Spanish master guitarmaker), documentary movie on: Granada guitar-making as intangible heritage: the traditional school of Granada guitar-makers and characteristics as a school, construction process and most traditionally and commonly used wood by guitar-makers of Granada.
- Bruno Salenson (French maker of traditional and early music oboes), demonstration/talk of: Traditional and early music oboes: design and making process of double reeds and of the bore.
- Samad Zare Mohazabiyeh (Iranian lutes Tar and Setar maker), demonstration and exhibition of: Wood and making techniques of Persian lutes Tar and Setar
- Katsuyoshi Ishida (Japanese Professor, maker of Japanese lutes), exhibition/talk of: Wood choice and making techniques of Japanese lute Biwa for different musical repertoires: Satsuma Biwa, Gagaku Biwa and Shikuzen Biwa
-
- Nelly Poidevin (French bow-maker), exhibition on: Diversity of woods and measuring techniques in bow making.
- Bernard Michaud (French sawyer specialized in wood for musical instrument), exhibition/talk on: Seeing the trees, … for the wood.

(3): Gala dinner + concert of Tornamai

The Gala dinner is FULL but it is still possible to come from 22h to the concert of Tornamai for 10€/ participant.

THURSDAY 11th of September

- WOOD TREATMENTS, FINISHING, VARNISHES AND LACQUER -

08:00 09:00	*Welcome and coffee*		
09:00 09:15	Introduction speech (English, Japanese, French)		
09:15 10:00	KeyNote 1	Eiichi Obataya	Effects of aging and of applied treatments or varnishes on the physical and acoustical properties of wood
10:00 10:15	Regular talk 1	Daniela Tesarova & al.	Influence of classic finished surfaces of massive wood on indoor environment
10:15 10:30	Regular talk 2	Miyuki Matsuo	Natural and accelerated aging of zelkova (Zelkova serrata Makino) wood
10:30 10:45	Regular talk 3	Delphine Jullien & al.	Hygro-mechanical behaviour of wooden panels from cultural heritage: effect of a coated face
10:45 10:55	FlashTalks	Jean Gérard (1) ; Martin Kovarik (1)	
10:55 11:25	*Coffee break & Poster Session*		
11:25 11:55	Long talk	Joseph Gril	The shape memory of wood: thermal softening and heat bending
11:55 12:10	Regular talk 4	Sara Robinson	Modern Spalting
12:10 12:40	Workshop I (2)	(Group1): François Perego - (Group2): Ryosaku Takeda	
12:40 13:10	Workshop I (2)	(Group1): Nicolas Gilles - (Group2): Bernadette Bakes	
13:10 14:30	*Lunch time*		
14:30 15:00	Workshop II (2)	(Group1): Ryosaku Takeda - (Group2): Nicolas Gilles	
15:00 15:30	Workshop II (2)	(Group1): Bernadette Bakes - (Group2): François Perego	
15:30 16:30	Round tables and conclusion of the symposium		
16:30 18:30	Beginning of laboratory visits in 2 groups: LMGC and CIRAD (3)		
19:00 23:00	*Musical event in the historical centre of Montpellier (4) - FULL -*		

(1) Poster:

- Jean Gérard & Catherine Gérard: Wood finishes used by traditional societies in Africa and oceania, and by European period furnishings restorers
- Martin Kovarik & al.: Anthropometric research of the adult population and its applications in architecture, interiors and furniture

(2): Workshop session I & II:

- **Ryosaku Takeda** (Japanese Professor of fine cabinet making) and **Yuki Ayabe** (expert Japanese woodturner), exhibition and potentially demonstration on: « The use of traditional Japanese coating: Urushi »

- **François Perego** (French restorer of painting and teacher on varnishes), talk/exhibition on: « Diversity in varnishes recipes and botanical origin of ingredients »

- **Bernadette Backes** (French cabinet maker, specialist in european traditional varnish), exhibition and potentially demonstration on: « The traditional technique of French Polish in cabinet making »

- **Nicolas Gilles** (French violin maker), exhibition and potentially demonstration on: « The multiple steps of wood finishing, varnishing and patina in violin making »

(3) Visits of wood laboratory (audience divided in 2 groups):
For those who are interested we propose to visits the Xylarium and sawmill of CIRAD (Tropical woods) and the Wood team of the LMGC (experimental rooms).

(4): Musical event: FULL

KEYNOTE SPEAKERS

François Calame

« Pre Industrial Timber Framing », Monday 8 (09:20 - 10:05)
Email: francois.calame@culture.gouv.fr

François Calame is ethnologist at the Regional Cultural Affairs Directorate of Upper Normandy (North of France). He completed his PhD, from EHESS (School of Higher Studies in Social Sciences, Paris) in 1983, with a dissertation « a study on rural carpentry in France ».
He has been interested and researching into carpentry for a long time, and has studied the practices of generations of craftspeople. He has filmed and photographed carpenters at work in France, Sweden, Romania, the Czech Republic, Turkey, etc., from the act of felling the tree all the way to the assembly and raising of frames and houses. He has also collected accounts about craft knowledge, the profession and how it is portrayed, including how trees are chosen, the right time to fell them, the art of the Scribe System, topping-off rituals, and so on.
François Calame has contributed and his deeply involved in many meetings of carpenters and collective projects as for example the « Charpentiers sans Frontières » of which he is the instigator (it is an international network of about 40 skilled carpenters). He has also published several books about carpentry.
First of all, François Calame is passionate for carpentry work and techniques, and help in many way to preserve the hand knowledge from France and other countries.

(Website: http://www.en.charpentiers.culture.fr/)

Hiroyuki Yamamoto

« Internal stress and dimensional instability of wood - a scientist's view », Monday 8 (11:35 - 12:20)
Email: hiro@agr.nagoya-u.ac.jp

Hiroyuki Yamamoto, born in Japan August 1961, obtained a PhD both from Nagoya University in Agricultural Science in 1993 and from Yamanashi University in Engineering Science in 2004.
He starts his academic career as Research Associate in 1988. Since 1995 in Nagoya University, first as Associate Professor of wood physics then from 2006 as Professor of Biomaterial Physics.
His research covers a wide scope of wood science, particularly concerning tree growth stresses and related problems, mechanics of wood at the tissue and cell wall level, quality and maturation of tropical fast-growing tree species. He has published about 90 articles in peer-reviewed journals (ex, Journal of Wood Science, Wood Science and Technology, Holzforschung, Annals of Forest Sciences, etc.). He also conducts a lot of research in South-East Asia and South America.
He was invited professor in 2007 in CNRS-Montpellier University 2 in France, and in 2013 and 2014 a CAPES Invited Professor in Federal University of Sao Carlos, Brazil.
Hiroyuki Yamamoto is a fellow of the International Academy of Wood Science since 2007.

Mechtild Mertz

« The wood species in Japanese craft and carpentry »,
Tuesday 9 (09:15 - 10:00)
Email: mechtild.mertz@free.fr

After having trained as a cabinetmaker and furniture restorer in Germany, Mechtild Mertz decided to pursue Japanese studies and East Asian Art History at the University of Heidelberg and the Sorbonne (Paris IV). She also studied wood anatomy at the Pierre et Marie Curie University (Paris VII). While working towards a PhD in ethnobotany from the National Museum of Natural History, Paris, she came to Japan to interview wood craftsmen under the auspices of Kyoto University's Research Institute for Sustainable Humanosphere (formerly the Wood Research Institute).
She published numerous essays on wood identification on temple structures, excavated wooden remains, and Japanese and Chinese Buddhist sculptures for European and US-American museums, such as the Metropolitan Museum of Art in New York and the Smithsonian Institution in Washington. She published Wood and Traditional Woodworking in Japan (Otsu, 2011), which describes woodcraft in Japan through the eyes of craftsmen. This book contains a glossary of woodworking terms as well as an appendix of Japanese timber names, both in Japanese, English, French, and German.
<u>Presentation</u>:
Based on interviews with a wide range of Japanese craftsmen, I will describe the materials, techniques, nomenclature, aesthetic principles, and cultural values of the various woodcraft fields, thus showing the technical and symbolic properties of Japanese wood. In a special focus I will further describe the rich panoply of wood species used in the various fields of traditional carpentry in Japan.

Patrick Perré

« Wood drying fundamentals and trade-offs », Tuesday 9 (11:35 - 12:20)
Email: patrick.perre@ecp.fr

Patrick Perré (52 years old) is the director of the Process and Materials Engineering Laboratory at Ecole Centrale Paris. He holds the title of ingénieur en chef des Ponts, des Eaux et des Forêts. Upon completing his training at the École Polytechnique, and then at the École Nationale du Génie Rural, des Eaux et des Forêts, he obtained a PhD in physics at the University of Paris Diderot in 1987, and then completed his HDR in mechanics/energetics at the Institut National Polytechnique de Lorraine in 1992.
He began his career at CNRS, and then became a Professor at ENGREF in Nancy, where he took part in the creation of LERMAB (Research Laboratory on Wood Material) in 2000, subsequently acting as its director from 2005 to 2008. He was then in charge of the Wood, Biomass, Biomaterials Team at LERFOB (Laboratory on Forest and Wood Resource), and has been director of the LGPM laboratory since September 2010.
Author or co-author of 115 articles in peer reviewed publications, 11 book chapters, as well as numerous scientific conference papers, he is also the recipient of two international awards.
Patrick Perré is well-known for his research on wood physics and processes, and particularly on wood drying. His current project at the LGPM Laboratory is to promote sustainable development in the field of process and materials engineering: "to do more or better with less, and with renewable resources." His scientific project revolves around two main axes: sober processes in matter and in energy, and the use of biomass and white biotechnologies.

David Van Edwards

« The Wooden Economy - Logistics solutions for Lutemakers »,
Wednesday 10 (09:00 - 09:40)
Email: lutes@vanedwards.co.uk

David Van Edwards is a lutemaker in Norwich (England) and conducts research into the history of European lutes and lutemaking techniques. Initially a scholar and University lecturer in early English literature, David Van Edwards made his first lute in 1967, at a time when most of the building characteristics and techniques had yet to be re-discovered. Since then he has studied all over Europe examining and measuring the few surviving lutes in museums and private collections in order to enhance the understanding of this most subtle and beautiful instrument. He writes extensively on the lute in art, where some of his insights into the iconography of the instrument have added to the understanding of the lute in society.
He is convinced of the importance of sharing the knowledge he has acquired through these years of research and experience in the workshop, and he teaches lute-making both at his own workshop in Norwich and at summer schools in Europe and this year for the first time in America.
David Van Edwards is currently President of the Lute Society in England.
Like many other luthiers he is aware of the rarity and vulnerability of the woods which have been used traditionally by lute-makers throughout the last 4 centuries, and the need to find sustainable alternatives which are capable of producing the desirable result. For this reason he is particularly pleased to have been invited to speak at this conference and to have the opportunity to learn from the other speakers.

(Website: http://www.vanedwards.co.uk/)

Kiyoko Motegi

« The "sound of wood" in Japanese traditional music instruments and soundscape »,
Wednesday 10 (09:40 - 10:20)
Email: motegi128@gmail.com

Kiyoko Motegi is musicologist, Emeritus Professor from Joetsu University of Education (Niigata Prefecture, Japan), after recently retiring from Ariake College of Education and the Arts. Prof. Motegi is an expert in Japanese traditional music and instruments with a particular interest in those sounds which are often neglected or no longer form a part of everyday life. Her research covers several fields:

- Transmission of Japanese music in the school curriculum
- Collecting of sake-making songs and transmission of regional performing arts
- Music and chanting of puppet theatre "Bunraku" as well as Kabuki backstage music instruments
- Buddhist music instruments
- Japanese traditional sound sources
- Japanese music instruments and sound sources in E.S.Morse collection

She is very much involved in the production and direction of concert performances of musics that exhibit traditional musical syntax and characteristics, particularly Japanese theatre music (she started her career as assistant director at the National Theatre in Tokyo). She is also involved in joint research with scholars

abroad regarding Japanese music. She has published several books and CDs on Japanese traditional music, musical instruments and sound sources.
The characteristics of Kiyoko Motegi's work is that, rather than focusing on traditional arts that have been in the spotlight, her research centres on less visible musical genres and practices that in fact function as important supports of the world of Japanese music. By studying the extraordinary characteristics of the many musical instruments found throughout Japan she hopes to locate the essence of Japanese music.

(Website: http://kiyoko-motegi.com/english/index.html)

Eiichi Obataya

« Effects of aging and of applied treatments or varnishes on the physical and acoustical properties of wood »,
Thursday 11 (09:15 - 10:00)

Email: obataya.eiichi.fu@u.tsukuba.ac.jp

Curriculum vitae:
1996 Awarded the degree of PhD for a thesis entitled "Physical Properties of Cane (Arundo donax L.) Used for the Clarinet Reed" at Kyoto University.
1996-1998 Postdoctoral Research Fellow (Wood Research Institute, Kyoto University)
1999-2001 Assistant Professor (Institute of Agricultural and Forest Engineering, University of Tsukuba)
2002-2003 Postdoctoral Research Fellow (Montpellier University II)
2003-2005 Postdoctoral Research Fellow (Institute of Wood Technology, Akita Prefectural University)
2005-present Associate Professor (Graduate School of Life and Environmental Sciences, University of Tsukuba)
Presentation:
First, recent findings on the mechanical and acoustic properties of aged wood are summarized. The adverse effects of ageing can be explained by the chemical changes in wood constituents, but convincing explanation for its positive effects has not been given yet. Second, the potential of heat treatment as a method of accelerated ageing is introduced. The heat treatment is a useful method to imitate the color and fragile nature of aged wood, but it is still difficult to reproduce the entire characteristics of naturally aged wood. Finally the effects of varnish and the excellent performance of Japanese lacquer (urushi) are introduced.

Long talk speakers

Mathieu Peeters

« Japanese Roof Geometry », Monday 8 (14:30 - 15:15)
Email: mathieu.p78@gmail.com

Inspired and immersed in many crafts from childhood by his craftsman-father, Mathieu Peeters started his woodworking carrier in Belgium, then in California for one of the leading building company specialized in Traditional Japanese Carpentry. There, under the tutelage of some of the most talented and experienced craftsmen, he learnt the techniques of Japanese carpentry craftsmanship under its CEO Len Brackett and Ryosei Kaneko, a Japanese teahouse carpenter.
In 2012 Mathieu Peeters went back to Belgium and created his own company, OostenWind (http://www.eastwind.be/) – an East Wind inc. subsidiary – in order to offer high quality woodwork to European clients.
OostenWind specializes in traditional, handcrafted carpentry and joinery. In collaboration with the clients they realize custom- made woodwork. OostenWind creates both finely handcrafted furniture and complete architectural projects. Since the craftsmen of the company are trained according to the Japanese tradition there work is strongly influenced by its aesthetics and methods.
Mathieu shares his passion for woodworking by giving talks and workshops. He also participates in international events to promote traditional woodworking skills, especially with the « Charpentier sans Frontière » (international network of about 40 skilled carpenters).
For his intervention, Mathieu Peeters will give a brief introduction into the Japanese layout system and roof geometry. He then expand further on some other topics regarding proportions and specific Japanese aesthetics as they are found in Sukiya zukuri (teahouse style carpentry).

(Blog: https://fabulalignarius.wordpress.com/)

Alain Mailland

« Artistic woodturning/sculpture from Mediterranean green wood »,
Tuesday 9 (14:30 - 15:15)
Email: alain@mailland.fr

Born in Africa in 1959, Alain lived in the suburb of Paris until the end of his studies at the National Art School of Cergy-Pontoise. Then he worked in several building companies as mason and carpenter near Paris. He created his own enterprise in 1991: carpentry, wood houses, sun houses, stairs, cabinets...
After a first woodturning course with Philippe Bourgeat in 1987, he developed his own personal production in green wood from the south of France. He specializes in green wood hollowing techniques and produces vessels, vases, dishes, salad bowls, lamps, lampshades, and since 1995, unique pieces known for their extreme thinness, turned, carved, sanded and textured and sometimes steam bent. He takes part in woodturning courses organized by the craft council of Vienne (France), with André Martel (Quebec), Michaêl Hosaluk (Canada), Terry Martin (Australia), Mark Sfirri and John Jordan (USA). These courses allowed him to refine his technique and creativity in woodturned creations as you can see them now.

In his workshop, near Alès in the sunny south of France, Alain Mailland juggles with aesthetics and techniques to create sculptures which are «a way of celebrating life and the secret wonders of burls and roots of the South of France ». (Website: http://mailland.fr/)

Iris Brémaud

« Wood mechanics viewpoint on biological and cultural diversity of instrument making woods »,
Wednesday 10 (11:35 - 12:05)
Email: iris.bremaud&univ-montp2.fr

Iris Brémaud is researcher at CNRS-National Centre of Scientific Research in the "Wood Team" of Laboratory of Mechanics and Civil Engineering in Montpellier. From her childhood immersed in the nature of Cévennes mountains (North of Montpellier), playing with wood shavings in her father workshop and listening to travelogues of field research in history/archaeology of techniques from her mother, she kept a passion for plants, wood and their technical uses by mankind. After training initially in plant biology, while starting to learn guitar and lute making, in 2000 she specialised her work on woods for musical instrument making through her MSc in Wood Science and PhD in Mechanics. Her dissertation (2006) was on "diversity of woods used or usable in musical instruments making". She subsequently continued research on this topic, focusing on cross-cultural views and on the structure-chemistry-properties relationships in wood mechanics, as a Post-Doc researcher at Kyoto Prefectural University, then at INRA-National Institute for Agronomical Research in Nancy (France), and at EMPA-Swiss Federal Laboratories for Materials Science and Technology.
Her current research in Montpellier aims at a systemic approach of wood behaviour, diversity and cultural uses, by relating fundamental wood physics/mechanics to botanical origin and to "hand knowledge" of wood craftsmen, still with a focus on musical instruments making. Ongoing works, often in collaboration with artisans, involve several PhD and Post-Doc subjects in link with national and international projects. Iris Brémaud is the initiator of this WoodSciCraft Symposium.

Joseph Gril

« The shape memory of wood: thermal softening and heat bending »,
Thursday 11 (11:25 - 11:55)
Email: joseph.gril@univ-montp2.fr

Joseph Gril was born in Créteil (France) in 1958. He graduated from Ecole Polytechnique and Ecole Nationale du Génie Rural, des Eaux et des Forêts. He obtained his PhD from University Paris VI in 1988, after long-duration stays in Kyoto University. A specialist of rheological modelling and structure/properties relationships in wood, since 1989 he held successive CNRS positions in the Laboratory of Mechanics and Civil Engineering of Montpellier University 2, and since 2004 led a group devoted to basic and applied knowledge on wood as a material, tree biomechanics, support of research in developing countries, introduction of wood culture in the university curricula. He contributed to the progress of wood mechanics in Europe by an active networking activity through the COST system. He established collaborations with wood scientists in Europe, Japan, China, Morocco, Iran, etc. where he usually contributed through data analysis and modelling. He maintained strong connections with research teams in Kyoto, Nagoya and Tsukuba through post-docs and various exchange programs of JSPS and

was hired as invited professor by Research Institute for Sustainable Humanosphere of Kyoto University during 5 months in 2009. He won the silver medal of CNRS in 2003. Since 2012 he leads a national network of wood science (GDR CNRS 3544). He published 68 ISI papers, 23 other papers or book chapters, and edited 2 books (06/2013).
Since 2008, Joseph Gril is member of the International Academy of Wood Science.

Presentation:
The cellular structure of wood allows large deformations that are often applied by craftsmen through forming (or shaping) techniques. The highest strain levels are obtained in transverse compression or shear thanks to microscopic cell-wall bending; their maximal value is inversely proportional to wood density. In the fibre direction, the longitudinal buckling of the cell walls allows a limited compression (typically up to 20%) but this is sufficient to produce a significant curvature of rods or plates, thanks to systems limiting the longitudinal tension. Preliminary softening through heating above the glassy temperature of lignin, that fall below 100°C when wood is wet, is required to reduce internal damage during forming operations. Although all woods can be softened and formed, their capacity to be bent easily and to large extents may vary considerably.

Crafts(wo)man intervention

Florian Carpentier

(Group1) « Dismantling, restoration, reassembly of a timbered sheepfold of the 18th century, from the baie de Somme (France) », Monday 8 (15:15 - 15:45)
(Group2) « Restoration of the frontage of a timbered manor from the 16th century, in Hebécourt (France) », Monday 8 (15:45 - 16:15)
Email: carpentierbois@gmail.com

Heir of 7 generations of joiners and carpenters in Picardie (North of France), Florian Carpentier has started his career as an engineer. After his diploma of general engineering (CESI School) he has worked 10 years in the industry (in the fields of mechanics and industrial automation). For his work he had to travel around the world looking at more and more complex industrial tools and technics.
Some years ago, he decided to break this link with the industry and to return to a more « human scale » of working. Naturally he went back to his origins of woodworking.
Always passionate for the pre-industrial timber framing and hand knowledge, he is now craftsman carpenter, and tries as much as he can to give his priority to the traditional techniques of carpentry.
Florian Carpentier was the head carpenter for the last project of "Charpentiers sans Frontières" (international network of about 40 skilled carpenters) on the partial reconstruction of the roof on the oldest part of the Château de Gaillon (in Haute Normandie, North of France).
(website: http://www.carpentier-bois.fr/)

Masaki Tatenaka

(Group1 & Group2) « Japanese carpentry and Sukiya-Tea House - Assembly of round wood »,
Monday 8 (15:15 - 15:45 and 15:45 - 16:15)

Masaki Tatenaka has been working for 3 years with Tadanori Kimura, a specialist in traditional temples and shrine architecture. He also worked for 8 years with Hiroya Watanabe, a specialist in traditional tea-room architecture.
Now he makes use of his learned Japanese traditional architectural methods not only for modern houses but also for the reconstruction of ancient buildings. Therefore he uses Japanese cedar (sugi), especially Kitayama-sugi from Kyoto's northern mountainous region

Benoît Dubost

(Group1 & Group2) « Demonstration of traditional beam squaring », Monday 8 (16:45 - 17:45)
Email: lecopeaudansloeil@gmail.com

Deeply passionate for the woodcrafts from the wood material to the hand knowledge, Benoît Dubost is at the head of a small company of carpentry (at the « human scale ») in Hautes-Alpes: Le copeau dans l'oeil.
He is deeply fond of the « craft philosophy » and the (re)use of traditional knowledge. He works by hand, from the forest to the house.

Benoît Dubost is also a member of « Charpentier sans Frontière » (international network of about 40 skilled carpenters) of which the ethics of transmission and sharing of knowledge suit him perfectly.
Benoît Dubost works in several projects through France. For works in his region of French Alps, he highlights the use of Larch, a species on which he has gained experience, and he favours construction and designs that make use of the natural curves and bends of trees.

(website: http://lecopeaudansloeil.com/)

Hiroyuki Ayabe

« Exhibition of wood blanks and turned pieces, and discussion of the place of wood figures in Japanese esthetics », Tuesday 9 (15:40 - 16:10 and 16:45 - 17:15)

The business of turning was started by Ayabe Yuki's father while his grandfather was a carpenter for shrines and temples (miyadaiku). Their hometown is located in Shizuoka Prefecture.
Ayabe Yuki lives in Kyoto and he is a member of the guild Fine Cabinetmaking of Kyoto or Kyô-sashimono. His workshop is located near Kyoto station. A large quantity of his work consists of turned objects for the tea ceremony or for monks.
The particularity of Fine Cabinetmaking of Kyoto (Kyô-sashimono) is that it includes a great variety of objects. Fine Cabinetmaking of Kyoto started during the Heian period, when the crafts were under the protection of the Court, aristocratic circles, temples and shrines. But the specialised sashimono-shi (woodworker of fine cabinetmaking) developed during the Muromachi period with the establishment of the tea-ceremony culture (sadôbunka). As the utensils of the tea ceremony (chadôgu) make up an important part of Kyô-sashimono the guild also admits turned objects (hikimono), carved objects (horimono) and bentwork (bentwork) to be a part of the guild.

Yano Kenichiro

(Group1, Group2 & Group3) « Demonstration of Camelia flower made by sculpting and plane shavings », Tuesday 9 (15:10 - 15:40 and 15:40 - 16:10 and 16:45 - 17:15)

Mr. Kenichiro Yano is a professional Buddhist starure scalptor. He studied engraving under Mr. Kocho Nishimura, who is not only leading authority of building Buddhist statures but also Buddhist monk, at Tokyo National University of Fine Arts and Music. After he graduate the university, he has been leading his own studio. His representative works on great religious statures are, for example, Cetaka (Fudo Myoou) of Nanzen-bo, Enryaku-ji temple 比 叡山延暦寺南善坊不動明王像, Zion, Hosso (Dharma characteristics Sect of Buddhism of Bodai-In, Kofuji-ji temple, 奈良県興福寺菩提院寺市慈恩大師像, Cetaka (Fudo Myoou) of Goma-do, Taian-ji temple奈 良県大安寺護摩堂不動明王像 Ksitigarbha(JIso Bosatsu) of Kongosan-ji temple奈良県金剛山寺地蔵菩薩像 and so on.
In addition he also resotre religious statures not only in Japan but also abroad like Angkor Wat. And he has been teaching Japanese engraving and Japanese art history for art major at the antique research center,Nara of Tokyo National University of Fine Arts and Music.
In this presentation, He is making treasured camellia motif which carry on the tradition of Todai-ji temple, Nara, by typical traditional wood hinoki with traditional Japanese techniques. Through this presentation, he would like to share his aesthetic feeling « A fair of Japanese and its underlying message -beauty is fragile, passing and pure - have been treasured by simplified form with spirituality « with participants of the symposium.

Ryosaku Takeda

(Group3 & Group1+2) « wood in Japanese Folk Art »,
Tuesday 9 (15:40 - 16:10 and 17:15 - 17:45)
and
(Group2 & Group1) « The use of traditional Japanese coating: Urushi »,
Thursday 11 (12:10 - 12:40 and 14:30 - 15:00)
Email: anacardia_kyoutokikakoubou@nifty.com

Ryosaku Takeda was born in 1947 and grew up in Kyoto. He graduated from the faculty of pharmacy, Kyoto University, and worked in the wood company « Jurinsha ». He studied wood and laquer work under Kenichi Kuroda who is the son of Tatsuaki Kuroda, a Living National Treasure.

He then studied lacquer work, especially Maki-e technique, under Noboru Higashibata.

Now he is leading, together with his wife, his own woodwork studio KYOUTO KIKAKOUBOU.

In his work he is making products, such as wooden furniture and handicrafts, but also restoring cultural assets, like wooden plates for traditional dyeing, carved wooden masks for traditional musical plays, as well as Jomon- and Yayoi-period wooden artifacts.

(Website: http://homepage3.nifty.com/kyoutokikakoubou/)

Sara Robinson

(Group2 & Group3) « Demonstration/exhibition of woodturning using spalted wood »,
Tuesday 9 (15:10 - 15:40 and 17:15-17:45)
Email: sara.robinson@oregonstate.edu

Sara Robinson is an assistant professor of the anatomy of renewable materials in the Department of Wood Science & Engineering at Oregon State University. She is also an artist, and displays her wood turnings colored with fungal pigments (spalting) throughout the world. Her research and artistic interests include wood anatomy, wood aesthetics, and fungal pigments.

(Website: http://www.northernspalting.com/)

Bernard Azema

(Group3 & Group2) exhibition/talk on: « Woodturning of very fine imbricated pieces called slender turning (or trembler) »,
Tuesday 9 (15:10 - 15:40 and 16:45 - 17:15)
Email: bernard.azema1@sfr.fr

Bernard Azema has started his career as cabinet and marquetry maker. Over time he moves toward joinery of stairs and joinery of wood mechanisms (as wood gears, or pulley for mill) with always a hight interest in wood turning.

The knowledge handover is in the center of his work, and as professor of carpentry in the high school of Bedarieux (South of France) he always try to involve his students in instructive project.

Bernard Azema share also his passion for woodworking by giving talks and by written technical articles for different wood specialized revues, and also by participating to workshops and exhibitions.

Among all the aspects of woodworking that he practice, he is being seized by passion for woodturning of very fine imbricated pieces called trembler (or wobbler). Indeed during his free times he spends hours and hours in his own workshop at turning complex forms on the bases of master pieces from the XVII and XVII century that he makes exceedingly complex. He runs the gauntlet of mechanics and physics law by making very fine and fragile pieces of art.

Daniel Gil de Avalle

(Group2 & Group3) documentary movie on: « Granada guitar-making as intangible heritage: the traditional school of Granada guitar-makers and characteristics as a school, construction process and most traditionally and commonly used wood by guitar-makers of Granada. »,
Wednesday 10 (14:30 - 15:00 and 16:00 - 16:30)
Email: info@gildeavalle.com

The work of Daniel Gil de Avalle, forged in the famous Granadine School of Guitar Makers of guitar-making, entails the constant search for art, love and beauty to achieve maximum harmonious and architectonic splendour in his guitars. Respect for the expertise of his ancestors and master guitarmakers together with his quest for innovation give his classical and flamenco guitars a magical blend of both classical and contemporary. His main objective is to build a powerful, balanced and sensitive guitars full of nuances for the guitar-players to indulge in.
Daniel Gil de Avalle is one of the few guitar makers who still constructs Granada style fine guitars, one of the heirs and descendant of this linage of guitar constructors. Gil de Avalle is an internationally renowned guitar-maker who modestly started guitar-making as apprentice from those who also were apprentices of the Pater Familia of the Granada School of Guitar Makers: fathers, uncles, brothers, fathers-in-law teaching their family guitar-making. Hence, familiarity is literally key and the "Granada School of Guitar Makers" can clearly trace their lineage of masters back to the XIX century. Daniel Gil de Avalle was also appointed Master Guitar-Maker by the Regional Government of Andalucia, which has included the guitar-making profession into the list of intangible heritage of Andalucia.

(Website: http://www.gildeavalle.com)

Bruno Salenson

(Group3 & Group2) demonstration/talk on: « Traditional and early music oboes: design and making process of double reeds and of the bore »,
Wednesday 10 (14:30 - 15:00 and 16:30 - 17:00)
Email: salenson@club-internet.fr

Native from the Cévennes (first mountain, north of Montpellier) Bruno Salenson is a talented maker of traditional (mostly from the Languedoc region) and early music oboes.

In the 1970's he becomes aware of traditional music from his area, and more specifically of an instrument that was nearly forgotten at that time: the Languedoc oboe. Even though he started is professional career by being a blacksmith, he was already spending his free times to make oboes in his workshop. He has been confronted to the fact that the knowledge was completely lost and had to be rediscovered and recreated, and with passion and perseverance he learnt himself the mostly forgotten making process of this traditional oboe.
He finally started his career as instrument maker in 1991 and settled his workshop in the centre of Nîmes (south of France).

Through several decades Bruno Salenson has developed a deep knowledge on wood behavior and properties, especially on box wood and on reeds. Bruno Salenson has a particularly unique expertise on the fabrication of double reeds, in link with different instruments and playing modes.

Samad Zare Mohazabiyeh

(Group1 & Group3) demonstration and exhibition of « Wood and making techniques of Persian lutes Tar and Setar »,
Wednesday 10 (15:00 - 15:30 and 16:30 - 17:00)
Email: zares32@yahoo.com

Samad Zare Mohazabiyeh was born 1962 in Shiraz, Iran. His connection to music started when he was a youngster, interested in traditional tunes. Samad began as a musician, learning to play Tar and Setar (Two long necked Iranian lutes) to perfection. He performed in groups as well as a member of orchestras, and also did some solo performances.
Samad made his very first instrument (a Tar) himself in Shiraz, without having prior experience in fabrication. It turned out fairly good and from then on he started seeking guidance and knowledge from other artisans, while experiencing on his own. He spent some years learning the details of instrument making in the workshops of Master Masood Salari (A professional Tanboor and Setar maker) and Master Ibrahim Ghanbari (A well known Tar maker). Since 1992, Samad fabricates Iranian instruments professionally. His own preferred instrument is Tar, though he also makes Setar and Tanboor and was awarded honors for the latter in Iranian Fajr music awards.
Samad now lives in Tehran, working in his atelier and directing his own music institute (Mehr Aieen Home Of Instruments) where a combination of Iranian and western instruments is thought by professionals.

Katsuyoshi Ishida

(Group1 & Group2) exhibition/talk of « Wood choice and making techniques of Japanese lute Biwa for different musical repertoires: Satsuma Biwa, Gagaku Biwa and Shikuzen Biwa »,
Wednesday 10 (14:30 - 15:00 and 16:00 - 16:30)

Mr. Katsuyoshi Ishida is a professional Biwa Maker for more than 25 years. He is the son of a "National Living Treasure" Biwa maker, Fushiki ISHIDA 4th of the very few Individual craftsmen in this category of Intangible Cultural Heritage for musical instruments making. Mr. Katsuyoshi Ishida, Fushiki Ishida 5th, produces Satsuma Biwa, Gagaku Biwa and Chikuzen Biwa. In addition he also performs Satsuma Biwa and traditional Biwa chanting, in Japan and also invited for performances abroad.
In this presentation, the making techniques and the choice and processing of wood for Japanese short-neck lute Biwa will be explained. Organological and making process differences will be presented between Satsuma Biwa (profane music accompanied by chanting), Chikuzen Biwa, and Gagaku,or court music instrument. The successive steps of Biwa fabrication starting from the wood will be shown with the support of a Powerpoint presentation. The talk/demonstration will also be supported by exhibiting some wood samples, tools, DVD on Biwa making, and finished Biwa instruments. Possibly, if time is available, a musical example of Satsuma Biwa could be played.

Nelly Poidevin

(Group3 & Group1) exhibition on « Diversity of woods and measuring techniques in bow making »,
Wednesday 10 (15:00 - 15:30 and 16:00 - 16:30)
Email: nelly.poidevin@wanadoo.fr

Nelly Poidevin is a bow maker based in Dinan (France). After being formed by Jean Grunberger, she established a workshop in 1984, first in Paris and, since 2000, in Brittany.
Since 1988, she specializes in the reconstruction of historical bows. Her practice for baroque and transitional bows is based on the copy of genuine bows from that era. But she is also involved in the study of earlier periods and, as very few surviving bows of that time have been preserved, she has gathered a great collection of iconographic sources, and written references to bows from the Middle Ages, Renaissance and early baroque era.
To date, she has made more than 1500 bows.
She regularly gives lectures and writes papers on the history of bows.
She is particularly interested in the woods that were used in the past for bowmaking. This has led her to do a lot of research on woods alternative to pernambuco with Iris Brémaud (LMGC, Montpellier) and acousticians from the LAUM (Le Mans, France). During the Woodscicraft demonstrations, she will present a software program carried out in collaboration with these scientists that allows craftsmen to measure physical characteristics of bows, among which mechanical properties of the wood, and calculates geometry changes implied by wood substitution.

(Website: http://www.archets-poidevin.com/)

Bernard Michaud

(Group2 & Group1) exhibition/talk on « Seeing the trees, ... for the wood »,
Wednesday 10 (15:00 - 15:30 and 16:30 - 17:00)
Email: info@bois-lutherie.com

Bernard Michaud is the head of a small sawmill company specialized in wood for musical instruments: « Le Bois de Lutherie », in Fertans (Doubs). Initially a lumberjack in the area of Haut-Jura (middle-East of France), Bernard Michaud got interested into "resonance wood" in the 1980's and settled the company in Fertans in 1992.
Skilful, globetrotter, curious and above all highly passionate for his work, he has developed a fantastic knowledge on trees and wood. He strides across the mountains of the Haut Jura in order to find the suitable Spruce tree of which the wood, after numerous and conscientious steps, will be used to make violins, cellos, viola de gamba, guitars, harpsichords, etc. For the emblematic curly Maple, it is in East of Europe that he journeys through forests and sawmills, and from times to times to Bosnia. A lot of other precious European species can find their place in his sawmill.
Eager of always having a new project, Bernard Michaud proposes since 2000 workshops for luthiers in an atelier adjoining the sawmill. He aims at creating the link between the forest and the luthier's workbench, in order to find an equilibrium between understanding which kind of wood the luthiers are looking for, and understanding what the forest can produce.
Bernard Michaud also shares his knowledge and passion for the trees and woods by giving talks in conferences.

(Website: http://www.bois-lutherie.com/)

Bernadette Backes

(Group2 & Group1) exhibition an demonstration on « The traditional technique of French Polish in cabinet making »,
Thursday 11 (12:40 - 13:10 and 15:00 - 15:30)
Email: atelierlevybackes@free.fr

Born in Germany in a small town, Bernadette Backes has decided after her baccalaureate to reorient her career from studying medicine to study restoration of old wooden furniture, with the desire of « healing» and giving them a second life.
From 1978 she has started her apprenticeship as « classical » journey-woman with a cabinet maker in a small town in Germany. After 2 years she went to several restorers in order to go further in her apprenticeship and to complete her studies in cabinet making/furniture restorer.
In 1982 she has obtained an European funding to participate at a specialized workshop for crafts(wo)men on preservation of cultural heritage objects for 3 months in Italy (in the island San Servolo, close to Venice).
She came to France in 1984 to share her life and a workshop with Luc Levy who is also restorer and cabinet maker.
Passionate for her work she has participated to numerous workshop, and was also involved in 2 associations (one on cabinet makers and the other on furniture restoration). She has also worked with the wood engineering school ENSTIB (North-East of France), and she teaches finishing and veneering for ancient pianos for the ITEMM (school of instrument making and maintenance in Le Mans, West of France).
Among her predilection domains she is specialized in all wood finishing aspects and in marquetry. She excels in traditional techniques, such as glue painting, hot wax, and more especially in the French Polish (called « vernis au tampon » in French).

Nicolas Gilles

(Group1 & Group2) exhibition/talk and demonstration on « The multiple steps of wood finishing, varnishing and patina in violin making »,
Thursday 11 (12:40 - 13:10 and 14:30 - 15:00)
Email: nicogilles@hotmail.com

Nicolas Gilles is violin makers in Montpellier. Born in this city in 1977, he learned violin making in Mirecourt and then Newark violin making schools. He then worked as violin maker assistant where he increased his knowledge in restoration and making. He set up is workshop in 2001 in his hometown. The sound and workmanship of his instruments are appreciated worldwide by talented musicians like Honggang Li, David Harding, Vadim Tchijik, Jose Mor...
Several medals in international violin making competitions have honoured his instruments.
He is inspired mostly by the 18th century Italian school. His skills and his curiosity help him to develop in an intuitive way his sensibility into the instrument sound and aesthetic.

François Perego

(Group1 & Group2) « Diversity of varnishes' recipes for lutherie and origin of natural ingredients : a cooking lesson… »,
Thursday 11 (11:10-11:40 and 15:00-15:30)
Email: francois.perego@free.fr

François PEREGO (born 1956) is a restorer of paintings, a free-lance researcher and teacher settled in Dinan (Britany). Since his childhood he was immersed into colour and research, through the laboratory and love for painting of his father, and the expertise into textile dyeing of his grandfather. After his initial orientation in medicine, he turns to visual arts (in which he holds a Master's degree) and becomes a restorer of paintings in 1980. Since the 1990's, he conducts research on the reconstitution of ancient pigments and vegetal pigments. His current researches are centred on materials applied to graphical arts and to instrument making, as well as on colour, especially the "material colour". François Perego is the author of the "Dictionnaire des matériaux du peintre" (Dictionnary of painter's materials), as well as of more than 30 articles in specialized journals, and many conferences. He collaborates with several producers of painting materials as well with institutions of cultural heritage. He is also a teacher, having conducted about 40 training courses in Europe on colours and pigments for fine arts, and mostly on violin-making varnishing. In 2012 he registered the trade name "Techniques, Traditions, Transmission (3T)" for his activities.
In his presentation at WoodSciCraft, he will approach two interrelated aspects of the "varnish recipe": (1) The ingredients (the 'grocery shopping list' and their natural origins); (2) The implementation of the recipe (the 'cooking method' and the combinatory of possible variants).

(Website: http://www.francoisperego3t.com)

Monday 8 (10:05 - 10:20) ***Sebastian Nemestothy & al.***

« ANALYZING AN AUSTRIAN FARM HOUSE – DATING, WOOD SPECIES AND WOOD QUALITY »

S. Nemestothy[1], A. Klein[1] and M. Grabner[1]
[1]University of Natural Resources and Life Sciences Vienna - BOKU, Vienna, Austria
sebastian.nemestothy@boku.ac.at, andrea.klein@boku.ac.at, michael.grabner@boku.ac.at,

Forests and their byproducts have been a substantial foundation for the life of farmers in rural Austria since earliest times. They were of high importance as a supply of building and heating material, but also as a basic food resource for the livestock [1, 2]. Former forests provided the most varied assortments of wood, considering both species and shape [3]. On the one hand side logs from straight grown trees of different qualities were used as beams for the construction of residential and farm buildings, on the other hand crooked trunks and side products like branches were used for special applications like fences, means of transport and everyday objects. When looking at wood species, we find a variety of trees and shrubs utilized according to their properties [4, 5].

In this paper the detailed analysis of a typical vernacular house from the south western part of Austria, Carinthia, is described. Nowadays the building is located, together with another 80 farm buildings, at the Austrian Open-Air Museum Stübing. During the first study the buildings and inventory of the museum have been analyzed regarding wood species, the shape of timber, specific to farming devices and tools, and dendrochronological dating [6]. In an ongoing investigation the amount of wood used for buildings and fences, the wood quality for selected buildings, the way of processing and the abrasion of wooden floors is being examined. The present paper aims to exemplary depict the comprehensive historical wood utilization in rural Austria by choosing the farmstead "Paule", originally from Reichenau in Carinthia, and characterizing the properties of the used wood and the building history.

The building consists of two stories built of log walls, made of spruce and is covered by a board roof, made of larch [7]. All wooden logs were measured (cross section and length) and the wood quality (number of knots, cracks, spiral grain etc.) was determined. The squared timber logs of the walls are showing an average profile of 13.2 cm width and a height of 23.5 cm. These logs are processed entirely by hewing with a broad axe; in some parts a waney edge is still present. Wood quality was evaluated for 443 wall logs with four different criteria, crack length and depth, presence of spiral grain, size and frequency of knots, as well as presence and amount of waney edge. According to these attributes 53% of the logs showed long and widely opened cracks, only 16% showed small to absent cracks, about half of the logs (51%) showed spiral grain, 44% were hewn sharp-edged and therefore showed no waney edge, whereby the highest percentage (79%) is found at the granary on the first floor. The knot size and occurrence is evenly spread with most logs (65%) classified as category 2 and 3 with scattered, medium sized knots, 20% show large and splay knots, 15% only have small knots. An individual characterization of each wall will show potential relationships between the different building phases and the wood quality.

Fig. 1: building phases of the farmstead "Paule"

In total, 81 cores of log walls, ceilings, floorings, roof construction and doors were taken for dendrochronological analyses. Coring took place with the help of a 16mm diameter hollow-core drill. Tree ring width measurements, synchronization and dating took place following standard procedures [8]. The analyses showed that two main construction periods were found, first one in 1548 and the second in 1690, a granary from 1528 was integrated into the framework. The building presents an interesting history: The ground level together with the roof construction dates back to 1690. The upper floor consists of timber harvested in 1548 and the granary, which dates back to 1528 [Fig. 1]. This indicates that the building was set up in 1690 using fresh as well as old wood. Interestingly, the ceiling construction from 1548 (Riemenbalkendecke [9]) was copied in 1690. Due to very few details and due to the dendrochronological dating it was possible to see the difference between the building phases. Ten parts of the inventory were successfully sampled: four chests, a table and a bench could be dated between 1455 and 1811.

Wood species identification was done with the help of small microsections done by hand and razor blades. Inside the building at 106 parts of the inventory the wood species was determined, thereby 16 different species could be identified these are: Scots pine (Pinus sylvestris), Stone pine (Pinus cembra), European larch (Larix decidua), Norway spruce (Picea abies), silver fir (Abies alba), common birch (Betula pendula), European beech (Fagus sylvatica), common hazel (Coryllus avellana), common ash (Fraxinus excelsior), sycamore maple (Acer pseudoplatanus), common hornbeam (Carpinus betulus), lime (Tilia spp.), poplar (Populus spp.), elm (Ulmus spp.), chequer tree (Sorbus torminalis) and Black locust (Robinia pseudoacacia). The building itself, the log walls, ceilings, floorings and the roof construction were set up using Norway spruce wood.

The amount of wood required for heating and cooking in former times is unknown. To get rough figures about the demand of wood for the smoke room, the stove was experimentally heated in winter time. Over a period of one week 2.3 cubic meters of stacked wood were needed.

The floors of the building were measured, in order to determine the abrasion due to the constant erosion. These abrasive processes occur because of small stones and sand brought in by the former residents and nowadays, visitors. An average wood loss between 1.28 mm in the bedroom and 6.74 mm in the smoke room was found. At the moment an investigation on preventing the historical floorings from further damage, by using less abrasive material for the walking paths in the museum, is carried out.

When investigating historical wood utilization, it becomes apparent that there is an ongoing risk of losing knowledge on ways and manners of forest and wood use by craftsmen and farm people. Although there is some information on industrial wood utilization and occurring wood demands of big cities hidden in archives of monasteries, former nobilities and state records, there is hardly any written source on wood demands in the countryside. Already in the year of 1917 folklorist Josef Blau [3] stated, that old skills, knowledge and experience are “absconding up the forests and mountains” and by this, getting lost. Conserving and regaining this knowledge is a major goal of the present analysis. By combining the gathered data on wood species, wood amounts and dating of timber found during this study, a broad picture of historical wood use in rural areas can be drawn.

ACKNOWLEDGEMENT:
This study was partly funded by the Austrian Science Fund FWF TRP 21-B16 and by the Austrian Ministry of Science, Sparkling Science SPA04-188. Within this project the following school students were working on the analyses of the building: T. Hörhan, F. Schöndorfer, M. Bauer and F. Beneditsch under the supervision of the teachers J. Fellner and E. Gautsch. We are thankful for the cooperation.

REFERENCES:

1. Swoboda, O. 1978. Alte Holzbaukunst in Österreich – Band 2. Salzburg: Otto Müller Verlag, 218p.
2. Wessely, J. 1853. Alpenländer und ihre Forste. Erster Theil: Die Natur, das Volk, seine Wirthschaft und die Forste der Österreichischen Alpenländer. Wien: Wilhelm Baumüller, 618p.
3. Blau, J. 1917. Böhmerwälder Hausindustrie und Volkskunst, 1.Teil. Wald und Holzarbeit. Prag: J.v. Calve, k.u.k. Hof und Universitäts Buchhändler, 419p.
4. Klein, A., Bockhorn, O., Grabner, M. (in review) Central European wood species: characterization using old
knowledge. European Journal of Wood and Wood Products.
5. Klein, A., Grabner, M. 2013. Holzauswahl zur Herstellung verschiedener Geräte. In: Grabner, M., Kohlross

H. (Eds.): Wald, Holz und Mensch. Festschrift zum 90. Geburtstag von Prof. Hiltraud Ast, 76-85p.
6. Klein, A., Grabner, M. 2014. Analysis of construction timber in rural Austria – wooden log walls. International
Journal of Architecturual Heritage, London: Taylor & Francis. DOI: 10.1080/15583058.2013.804608.
7. Pöttler, V. H. 1999. Mit Tradition und Innovation. Stübing bei Graz: Selbstverlag des Österreichischen
Freilichtmuseums, 462p.
8. Baillie, M. G. L. 1995. A slice through time. Dendrochronology and precision dating. London: B.T. Batfords Ltd, 180p.
9. Grabner, M., Klein, A., Nemestothy, S., Salzger, E. 2013. Ceilings and floorings – city versus rural buildings in Austria: type, date and wood species. Presentation at the International Study Day: From Carpentry to Joinery: Floors and ceilings, door and panelling in medieval and modern architecture. Royal Institute for Cultural Heritage, Brussels, Belgium, 29th to 30th November 2013, 7p.

Monday 8 (10:20 - 10:35) ***Clémence Ogéron & al.***

« LOCAL KNOWLEDGE ABOUT USES AND TECHNOLOGICAL PROPERTIES OF CONSTRUCTION TIMBER OF BAS-OYAPOCK (FRENCH GUIANA) »

« SAVOIRS LOCAUX SUR LES USAGES ET LES PROPRIÉTÉS TECHNOLOGIQUES DES BOIS DE CONSTRUCTION DANS LE BAS-OYAPOCK »

OGÉRON Clémence [1, 2], DAVY Damien [1], BEAUCHENE Jacques [2], ODONNE Guillaume [2], CLAIR Bruno [2]
(1) Observatoire Hommes/milieux « Oyapock », USR 3456 CNRS-Guyane, Cayenne
(2) UMR Ecologie des Forêts de Guyane (EcoFoG), Kourou
clemence.ogeron@ecofog.gf

In French Guiana, 96% of the territory is covered by tropical rainforest, counting more than 1,600 wood species (Molino & al. 2009). Despite this high biodiversity, only three species (Angelique Gonfolo, Grignon) accounts for more than 70% of the harvested volume for timber (ONF, 2004; Detienne, 1990). This low representation of wood diversity in construction is due to both the low volumes available for each species than an industrial process based on large diameters woods.

However, in French Guiana, and more specifically the low-Oyapock area, local people hold a very rich "ethno-technological" knowledge associated with woody species for wooden houses building, such as Amerindian carbets, Creole houses or Amazonian piles dwellings (Grenand, 1980; Ouhoud-Renoux, 1998; Davy, 2007, 2010a, 2010b; Jabin, 2003; Grenand, 1995; Martin, 2005; Cousseau, 1999; Pérez & Archambeau, 2012). However, since the opening of the N2 road in 2003 and the construction of the connecting bridge between French Guiana and Brazil, this geographical area is undergoing deep changes, especially in the ways of living, probably associated with a loss of knowledge transmission about traditional wood buildings.

The main goal of this work is to make an inventory of the knowledge and practices related to the use of wood in traditional buildings in different communities of the lower Oyapock. It will focus on how the wood technological properties, transformation and implementation explain their traditional use. This will be addressed through a multidisciplinary approach involving ethnobotany and wood science. Field surveys are conducted in Saint-Georges de l'Oyapock, Regina and Ouanary with Amerindian populations (Palikur, Karipun, Galibi-marworno), Creoles, Saramaka and Brazilian migrants (Davy & al. 2011).

First results highlight the diversity of wood used in the buildings of these communities, as well as an important use of low diameter species (5-15 cm) by Palikurs. Physical and technical characteristics (mechanical, natural durability to fungi and termites ...) of these roundwoods will then studied in the laboratory to link wood technological properties to the diversity of uses in construction. The study of these properties will probably also initiate new tracks for the use of these woods in the current systems of construction.

(FRENCH VERSION)

En Guyane, 96% du territoire est couvert par une forêt tropicale humide qui compte plus de 1600 espèces de ligneux (Molino 2009). Malgré cette grande biodiversité, trois essences de bois seulement (Angélique, Gonfolo, Grignon) représente plus de 70% du volume exploité pour le bois d'œuvre (ONF, 2004). Cette faible représentation de la diversité des bois dans la construction est autant due aux faibles volumes disponibles par essence qu'à la structuration de la filière traditionnellement autour d'arbre de gros diamètre à bois durables. Parallèlement en Guyane, et plus précisément dans la région du bas-Oyapock, il existe des peuples qui détiennent encore un savoir « ethno-technologique » très riche lié aux espèces ligneuses servant à la construction de maisons en bois, que ce soient des carbets amérindiens, des cases créoles ou des habitats palafittes amazoniens (Pérez & Archambeau, 2012; Grenand, 1980 ; Davy, 2007). Cependant, depuis l'ouverture de la RN2 en 2003 et la construction du pont, reliant la Guyane française au Brésil, cette zone géographique à l'instar de tout le littoral guyanais subit de profondes mutations, notamment dans les modes d'habiter, impliquant probablement une perte de la transmission des savoirs autour de la construction traditionnelle en bois.

L'objectif de cette recherche est de dresser un état des lieux des savoirs et pratiques liés à l'usage des bois dans la construction artisanale chez les différentes communautés du bas-Oyapock, afin de comprendre comment les propriétés technologiques des bois, les critères de sélection, de transformation et de mise en œuvre permettent leur utilisation traditionnelle. Cette problématique sera abordée via une approche pluridisciplinaire faisant appel à l'ethnobotanique et aux sciences du bois. Des enquêtes de terrain sont menées sur les communes de Saint-Georges de l'Oyapock, Régina et Ouanary auprès des populations amérindiennes (Palikur, Karipun, Galibi-Marworno), créoles, Saramaka et migrants brésiliens.

Les premiers résultats mettent en évidence la diversité des bois utilisés dans la construction par ces communautés, ainsi que l'emploi par les Palikur de bois ronds de faible diamètre exploitable (5-15 cm) négligés par les technologues et les forestiers. Les propriétés et caractéristiques physiques et technologiques (mécanique, durabilité naturelle aux champignons et aux termites…) de ces bois ronds seront ensuite étudiées en laboratoire afin de mettre en relation les propriétés technologiques avec la diversité des usages. L'étude de ces propriétés nous permettra sans doute d'emmètre des hypothèses d'utilisation des bois ronds dans les systèmes de construction actuels.

REFERENCES:

Cousseau J. M., 1999. Valoriser l'artisanat du bois chez les Noirs-Marrons de Guyane: un défi technico-économique ou juridico-politique? Montpellier, Montpellier, Mémoire de fin d'étude du DITARC, 94 p.

Davy D., 2007. Vannerie et Vanniers : approche ethnologique d'une activité artisanale, Thèse de Doctorat, Université d'Orléans, 526 p.

Davy D., 2010a. "Vannerie et usage de la nature : des pratiques interdépendantes. Cas des Palikur et des Arawak-Lokono de Guyane française", in E. Barone-Visigali & A. Roosevelt (éds), Sciences de l'Homme, Sciences de la Nature : vers une éco-anthropologie ? Réflexions sur l'Amazonie, Ibis Rouge éditions, Cayenne, pp. 383-402.

Davy D., 2010b. "Bois, fibres, feuilles, écorces, plumes… une culture matérielle végétale ", in G. Migeon (éd.) Amérindiens de Guyane des cultures millénaires, entre les fleuves Approuague et Oyapock, Musée d'Archéologie nationale, Saint-Germain en Laye, pp.58-73.

Davy D., Grenand F., Boudoux d'Hautefeuille M. & Nicolle S., 2011. « Du manioc aux Rafales : un Observatoire Hommes/Milieux sur la frontière franco-brésilienne », in J. L. Rebelo Porto 4 & E. Doff Sotta (eds), Reformatações fronteiriças no platô das Guianas : (re)territorialidades de cooperações em construção,), Editora, Macapa

Detienne, P., Fouquet, D., Parant, B., 1990. Les bois guyanais. Propriétés et utilisations. Bois et Forêt des Tropiques, 219, pp.125-143.

Grenand P., 1980. Introduction à l'étude de l'univers Wayãpi: ethnoécologie des indiens du Haut-Oyapock (Guyane-française). Paris, SELAF.

Grenand P., 1995. De l'arc au fusil: Un changement technologique chez les Wayãpi de Guyane. Transitions plurielles: exemples dans quelques sociétés des Amériques. F. Grenand et V. Randa, Paris, Peeters: pp. 23-53.

Jabin, D. H., 2003. Les pirogues en Guyane: prémices à une étude ethnobotanique et socio-économique de la construction et du commerce des pirogues en Guyane française. Orléans, Université d'Orléans, DEA, 116 p.

Martin E., 2005. Technologie et ethnoécologie des activités de prédations des Wayãpi méridionaux. Projet d'étude doctorale, Université de Nanterre Paris X, 51 p.

Molino J.-F, D. Sabatier D., M.-F. Prévost, D. Frame, S. Gonzalez et V. Bilot-Guérin, 2009. Liste des espèces d'arbres de la Guyane Française. Rapport final de la Convention E 24/08 Ministère de l'Agriculture et de la Pêche – IRD. IRD, Cayenne-Montpellier, 59 p.

ONF, 2004. La forêt et le bois en Guyane : le cadre institutionnel se met en place. INSEE, Forêt, N°61, 2 p.

Ouhoud-Renoux F., 1998. De l'outil à la prédation: technologie culturelle et ethnoécologie chez les Wayãpi du Haut-Oyapock (Guyane-française). Paris, Paris X, Thèse de Doctorat, 479 p.

Pérez P. & Archambeau O., 2012, Architecture et paysages de Saint-Georges de l'Oyapock. Rapport pour le compte de l'OHM Oyapock, Cayenne, 238 p.

Monday 8 (10:50 - 10:55) ***Catherine Lavier & al.***

« AKHAN PROJECT: ALBERT KAHN, ARCHAEOLOGY OF A NIPPON HERITAGE »

J.-S. Cluzel, C. Lavier
Centre de Recherche sur l'Extrême Orient de Paris Sorbonne (CREOPS)
Art et archéologie de l'Extrême-Orient
Institut National d'Histoire de l'art (INHA)
Université de Paris 4 Sorbonne, 2, rue Vivienne 75002 Paris, France
jeancluzel@hotmail.com, Catherine.lavier@upmc.fr

In collaboration with :
V. Asensi Amoros, T. Itoh, T. Mitsutani, R. Brageu, le NISHIDA LAB KIT, YAGASAKI LAB KIT, AVENUES (Avenues Research lab on Urban Systems Engineering) / UTC, F. Decuq et T. Guillou

The "Japanese factories" of the garden Albert Kahn - four buildings imported by the Japanese archipelago by 1900 - are going to be restored between 2014 and 2015. This restoration will be made according to a Japanese traditional method: dismantling and total reassembly. Implementation for this restoration, this will allow to make an incomparable archaeological investigation with scientific and educational outlines. Our project aims at questioning the identity of these patrimony - origin, routing, application in Japan then in France, diversity, etc. - by means of various archaeological approaches which complement each other, such as the archaeology of the forms and the techniques, the archaeology of the know-how, the archaeology of materials, the archaeology of the light.

This French-Japanese architectural heritage has no equivalent in Europe. This work will be realized by Japanese carpenters specialized in the restoration of buildings having a "high patrimonial value ". Every building will be completely unsettled to be, three month later, completely reconstructed. This process of "dismantling-reassembly" is current in Japan for the important heritage, it allows archaeologists to lead their research in ideal conditions: analysis of the building element by element. Moreover, the link between partners, belonging to two different scientific bodies - archaeology and engineering-, will allow to give another scale to their own researches : archaeological researches will be "modelled" and will restore the various "states" of buildings. These factories are the last ones and the most important witnesses in France, of architectural exchanges between France and Japan of the end of the XIXth century. These buildings are a part of the biggest collection of Tea House in Europe. This type of architecture being extremely rare in Japan, their patrimonial value is shared.

The poster will present this project which allies archaeology and engineering (shape, technique, textures, materials, light, know-how), pedagogy (about twenty students are concerned), modellings and includes this often ignored « human and craft dimension » .

(FRENCH VERSION)

Les « fabriques japonaises » du jardin Albert Kahn – quatre édifices importés de l'archipel nippon vers 1900 – vont être restaurées entre 2014 et 2015. Cette restauration va être effectuée suivant une méthode traditionnelle japonaise : démontage et remontage total. Mise en œuvre pour cette restauration, elle va permettre d'effectuer une enquête archéologique sans commune mesure avec des contours scientifiques et pédagogiques.

Notre projet vise à interroger l'identité de ce patrimoine – provenance, acheminement, mise en œuvre au Japon puis en France, mixité, etc. – par le biais de différentes approches archéologiques qui se complètent, telles que l'archéologie des formes et des techniques, l'archéologie du savoir-faire, l'archéologie des matériaux, l'archéologie de la lumière.


Exemple d'un des deux pavillons

Ce patrimoine architectural franco-japonais est sans équivalent en Europe. Ce chantier va être réalisé par des charpentiers japonais spécialisés dans la restauration d'édifices « à haute valeur patrimoniale ». Chaque édifice va être entièrement démonté pour être, trois moins plus tard, entièrement remonté. Ce processus de « démontage-remontage » est courant au Japon pour le patrimoine important, il permet aux archéologues de conduire leur recherche dans des conditions idéales : analyse de l'édifice pièce à pièce.

De même, le rapprochement de partenaires appartenant à deux corps scientifiques distincts – archéologie et ingénierie –, permettra de donner une autre échelle aux recherches de chacun : les recherches en archéologie seront « modélisées » et restitueront différents « états » des bâtiments.

Ces fabriques sont les derniers et les plus importants témoins en France, des échanges architecturaux entre la France et le Japon de la fin du XIXe siècle. Ces édifices font partie de la plus grande collection de pavillon de thé en Europe. Ce type d'architecture étant extrêmement rare au Japon, leur valeur patrimoniale est partagée.

Le poster présentera ce projet qui allie archéologie et ingénierie (forme, technique, texture, matériaux, lumière, savoir faire), pédagogie (une vingtaine d'étudiants sont concernés), modélisations … et inclue cette « dimension humaine et artisanale » souvent ignorée.

REFERENCE:

CREOPS (2013) colloque « Architectural Exchange : Europe and East-Asia, 1550-1950 », 21-22 février 2013

Monday 8 (10:35 - 10:50) ***Lisa Shindo et al.***

« DENDROCHRONO-ECOLOGICAL AND ARCHAEOLOGICAL STUDY OF TRADITIONAL BUILDINGS IN THE SOUTHERN FRENCH ALPS »

L. Shindo[1], J.-L. Edouard[1] and F. Guibal[2]
(1) Centre Camille Jullian, UMR CNRS 7299, Aix-en-Provence, France
(2) Institut Méditerranéen de Biodiversité et d'Ecologie marine et continentale, UMR CNRS 7263, Aix-en-Provence, France
shindo@mmsh.univ-aix.fr, edouard@ mmsh.univ-aix.fr, frederic.guibal@imbe.fr

This presentation fits into a PhD at the Camille Jullian Centre in Aix-en-Provence, under the supervision of Jean-Louis Edouard and Frederic Guibal.

It aims to understand history of human occupation, timber uses and forest management in the Southern French Alps by using an interdisciplinary approach combining dendrochronological study of traditional buildings, archaeological and textual data analysis.

Fig. 1: Location of Val-des-Prés village (map: geoportail.fr)

Two French regions in the Durance basin were selected : Bléone valley in the Alpes-de-Haute-Provence (04) and the Briançonnais in the Hautes-Alpes (05).

Both of these mountain areas have a complex forest history because even though men realized quite early the value of forests preservation for economic reasons (since the11th century [1]) and the importance of protecting themselves from climate-related disasters (since the 13th century [2]), size of wooded areas have significantly changed over time.

Trees of these forests were exploited among other things for construction (civil, religious and military buildings) and this rich wooden heritage – not very studied though – disappears little by little today as a result of abandonments or restorations [3 and 4]. However, these constructions are witnesses of the evolution of mountain societies and the timber used into it, helps understanding the human impact on these territories, particularly on forests.

Dendrochronology is the science that studies the tree rings of trees in order to date them. When dendrochronology is applied to archeology, it focuses on assigning the felling year or season of the tree in order to put a date on the building of the site studied [5]. Indeed, timber was usually utilised "green" (not dry) in the buildings we are interested in.

It is possible though to go further the dating since tree rings contain plenty of informations: climatological and ecological conditions, human factors and occasional human impacts. It is therefore possible to reconstruct the environment in which the tree has lived. [6]

We propose to address the first results of this study by providing a focus on Val-des-Prés, a village located in the Clarée valley in Briançonnais (Fig. 1). This village, formerly located on a road between Italy and Provence is still a frequented and active thoroughfare [7]. Moreover Val-des-Prés still holds many houses once used as permanent residences, not yet restored. Dendrochronological analyzes on seasonal altitude settlements have already been led by J.-L. Edouard in the upper valley of Clarée, Névache [8]. Then, the comparison between these permanent and temporary constructions, and the timber that have been implemented, is possible.

Our analysis focused on 87 timber pieces used in six different houses, as well as in the structural work (timber frame, roof trusses, floor, stack like "blockbau") than in the second work (frames, roofing, manger).

If larch (Larix decidua Mill.) is the most present species (over 60%), contrary to what oral tradition suggested Scots pine (Pinus sylvestris L.) and fir (Abies alba Mill.) were also used. The use of both thesespecies is different because until now, the roof trusses studied are systematically made in larch, unlike joists for example. Dendrochronological analyzes also highlight the types of wood used (age of the trees, variety of growth).

Two major felling phases have emerged as far as Val-des-Prés is concerned. The first one in the mid 17th century confirms the dating inscriptions carved on some beams (Fig. 2) The second one, at the end of the 18th century, doesn't fit with dating inscriptions. This is also the case of medieval results and dates obtained for seasonal Névache houses (the dating inscriptions tradition appears only during the 15th century). Dendrochronology highlights the not yet referenced construction phases and helps understanding the complex history of these buildings.

I will conclude this presentation insisting on the good sanitary conditions of these old timber used in the buildings, and how crucial is their preservation. And I will also compare the results obtained in Val-des-Prés with other Briançonnais village, as well as some results obtained in the Bléone valley.

Fig. 2: Farmhouse, Val-des-Prés (05). Dating inscription details [IHS / 1648], on the western roof truss of the framework (photographs L. Shindo)

REFERENCES :

1. M. Chalvet (2011), Une histoire de la forêt (Seuil, Paris), 351p.
2. G. Chenard, M. Galvin-Demoz et D. Valle de loro (2012), Auprès de mon arbre... La forêt dans les Hautes-Alpes d'y il a longtemps à nos jours, Dossier thématique des archives départementales des Hautes-Alpes (Agence culturelle du conseil Général), 100 p.
3. M.-P. Mallé (1999), L'habitat du nord des Hautes-Alpes. Patrimoine architectural et mobilier (Association pour le patrimoine de Provence et Société d'étude des Hautes-Alpes, Aix-en-Provence), 440p.
4. F. Guibal et J.-J. Meyran (2011), Reconstitution de l'habitat de la vallée du Bachelard au cours des derniers siècles par la dendrochronologie, in J.-P. Mallet (dir.) : La vallée de l'Ubaye : un territoire unique pour les recherches en géosciences, Actes du colloque d'ouverture, Barcelonnette, 12-16 Septembre 2011 (SELOANE, Barcelonnette), p.71-72
5. G.- N. Lambert (2011), Dendrochronology, archaeology and sciences, in P. Fraiture (dir.) : Tree Rings, Art, Archaeology, Proceedings of the conference, Brussels, Royal Institute for Cultural Heritage, 10-12 February 2010, (Scientia Artis, Bruxelles), p.19-29
6. L. Shindo (2012), Patrimoine bâti et dendrochronologie dans le Briançonnais (Alpes du sud). Datations, usages du bois et dynamisme de l'activité humaine depuis l'époque médiévale (13ème siècle). Edouard J.-L. (dir.). Mémoire de Master 2, Université de Bourgogne, non publié, 66p.
7.N. Vivier (1992), Le Briançonnais rural aux XVIIIe et XIXe siècles (L'Harmattan, Paris), 296p.
8. J.-L. Edouard (2010), Longue chronologie de cernes du mélèze et occupation humaine depuis plus de mille ans dans la vallée de la Clarée (Briançonnais, Alpes françaises), in S. Tzortzis et X. Delestre (dir.) : Archéologie de la montagne européenne, Actes de la table ronde internationale de Gap, 29 septembre-

1er Octobre 2008, Bibliothèque d'archéologie méditerranéenne et africaine, n°4, (Errance, Paris), p. 325-333

Monday 8 (11:35 - 12:20) ***Hiroyuki Yamamoto et al.***

«INTERNAL STRESS AND DIMENSIONAL INSTABILITY OF WOOD - A SCIENTIST'S VIEW »

H. Yamamoto, M. Tanaka, M. Yoshida, M. Matsuo, K.C. Sujan, K. Toba
Laboratory of Bio-material Physics, Nagoya University , Chikusa, Nagoya 464-8601, Japan
Email: hiro@agr.nagoya-u.ac.jp

BACKGROUND:

When we manufacture the building, the furniture, the cabinet, and the other craft object, we first convert seasoned raw materials into the structural members as accurately as possible with reference to the predefined blueprint. At this process, unexpected distortion or destruction often occurs in a workpiece. We must repair or remove those defective workpieces before the following assembling process. After that, the structural members are assembled into the final products, and those products are offered to the market or the clients. In a final product, each member is desired to keep its original dimension; however, delayed distortion is often generated in some members during use. Defects due to the dimensional instability seriously deteriorate not only economic efficiency but also the reliability and the safety of the timber product. It is thus one of the most important and fundamental issues for the timber engineers and the wood craftsmen/craftswomen to improve dimensional stability of the wood.

It is well-known that dimensional instability of the wood is highly related to generation or extinction of the internal stresses. Typical examples are as follows: the growth stress (GS) which is generated and remains in a living trunk during the tree growth, the drying stress (DS) which is caused by the heterogeneity of the drying shrinkage in the dried lumber, and the other internal stresses which are induced by artifactual processes, e.g. adhesion or connection of two parts under the action of external loadings, impregnation and hardening of resin, generation of localized plastic deformation, and so on so forth. For developing the technique to avoid the dimensional instability of the wood, it is indispensable to understand why and how the internal stresses are generated in wood as well as to know how the internal stresses affect the dimensional instabilities of wood. In this presentation, we talk about the causes of dimensional instabilities of the wood in relationship to two major internal stresses in wood, i.e., growth stress (GS) and drying stress (DS).

HOW THE INTERNAL STRESSES AFFECT DIMENSIONAL INSTABILITY OF THE WOOD?

Maturing xylem fiber tends to change its length and diameter during the cell wall lignifications. Dimensional change of maturing fiber is more or less restricted inside an actual trunk; thus, an internal stress is generated in the thin layer of the newly-formed secondary xylem. This is called "the growth stress (GS)". Some component of the GS is elastically stored, whereas the other is visco-elastically stored as a locked-in stress in the cell wall after the programmed cell death. Magnitude of released strain of elastic component of the GS in the newly-formed xylem is normally an elongating value of 0.05 ~ 0.15 % in the tangential direction, a contractile value of 0.05 ~ 0.1 % in the longitudinal direction, and 0 % in the radial direction [1]. However, in the reaction wood, it becomes an abnormally higher value in the longitudinal direction: an elongating value higher than 0.3 % in the compression wood, while a contractile value higher than 0.2 % in the tension wood [1].

The elastic component of the GS is piled up inside a living trunk after the repetition of diameter increase, causing a residual stress distribution in a trunk [1]. This is released immediately after harvesting a log, followed by cutting the green log into small boards or planks; thus, undesirable distortions are often caused in the sawn lumber, e.g., heart check at the ends of the log, crooking and longitudinal cleavage of the planks, and so forth, as shown in Fig.1.

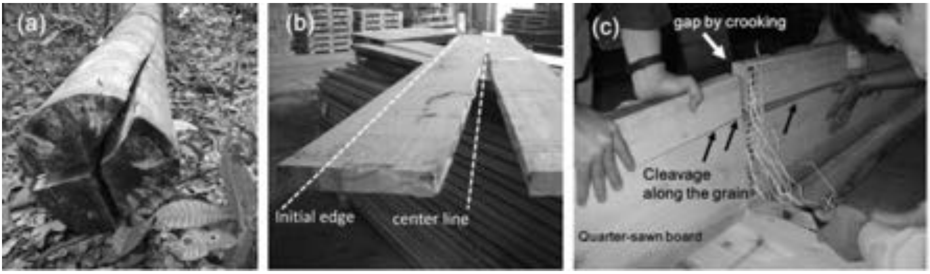


Fig. 1 Distortions due to release of elastic component of GS in the green wood.
(a) Heart check (b) Crooking of lumber (c) Longitudinal cleavage
(Photographs: (a); H. Yamamoto; (b) and (c); M. Kojima)

The **viscoelastic locked-in component of the GS** still remains even after a small lumber is separated from the living trunk. However, it is tardily released by immersing a green small lumber in hot water; as the result, an irreversible distortion is induced in the heated lumber. This is known as the **hygro-thermal recovery (HTR)** [2~8]. Magnitude of HTR strain is normally an elongating value of 1.0~1.2 % in the tangential direction, an elongating but sometimes contractile value of 0.05 ~ 0.1 % in the longitudinal direction, and a contractile value of 0.05 % in the radial direction [7]. However, in the reaction wood, the HTR strain becomes abnormally higher in the longitudinal direction: elongating value of 0.2 ~ 0.8 % in the compression wood [8], and contractile value of 0.6 ~ 1.0 % in the tension wood [6].

Fig. 2: A severe end splitting in a small log of European beech (a sketch drawing from Kubler [2]). This log contains tension wood in presenter's view.

When the green lumber is dried at higher temperature using a kiln dryer, distortion due to the HTR is superimposed on the reversible distortion due to the **drying shrinkage** [6,8]. Magnitude of drying shrinkage from the green to the oven-dry conditions is normally contractile values of 5 ~ 10 % in the tangential direction, 0.1~ 0.5 % in the longitudinal direction, and 2 ~ 5 % in the radial direction [9]. In case of containing the reaction wood fiber, the drying shrinkage strain also becomes abnormally higher contractile in the longitudinal direction [6,8]; thus, problems arising from dimensional instability become more complicated and more serious in the timber containing the reaction wood (see Fig.2).

When the green lumber is dried at room temperature, the viscoelastic component possibly remains unreleased in a dried lumber, and may relax gradually over a longer period of time, which is more or less accelerated by the fluctuation of the moisture content [10]. This may lead to unexpected dimensional instability of the members in the final product.

Thus, lumber industry often suffers from those **three kinds of instabilities,** i.e., distortions due to the elastic recovery of GS, the viscoelastic recovery of GS, and drying shrinkage due to moisture desorption.

INTERNAL STRESSES IS CONTROLLED BY HETEROGENEOUS STRUCTURE OF THE WOOD CELL WALL

Generation mechanisms of the **elastic component of the GS** and **the DS** have been well investigated in relationship to the microscopic structure of the wood cell wall [11]. For instance, the microfibril angle (MFA) in the S2 layer plays a key role in controlling the magnitudes of released strains of the elastic component of the GS and drying shrinkage of the fiber. Therefore, the reinforced-matrix theory can be applied to explaining the origins of **the elastic component of GS** and **the DS** [12]. On the other hand, little is known about microscopic mechanism of generation of the **viscoelastic component of the GS** excepting a few reports [6,10]. Developing techniques to control dimensional stability of the wood is not possible without understanding the underlying mechanisms. We expect to propose a practical way to remedy the dimensional instability of the wood due to the internal stresses based on the revealed mechanisms.

REFERENCES:

1. R.R. Archer (1986), Growth stresses and strains in trees (Springer-Verlag, Berlin)
2. H. Kübler (1959), Studien über Wachstumsspannungen des Holzes III. Längenänderungen bei der Wärme-behandlung frischen Holzes. (Studies of growth stresses in trees Part 3. Effect of heat treatment on the dimensions of green wood.) (Holz aks Roh- und Werkstoff 17:77-86)
3. T. Yokota and H. Tarkow (1962), Changes in dimension heating green wood (Forest Products Journal 12:43-4.
4. Y. Sasaki, and T. Okuyama (1983), Residual stress and dimensional change on heating green wood (Mokuzai Gakkaishi 29:302-307)
5. J.Gril, and B. Thibaut (1994), Tree mechanics and wood mechanics: relating hygrothermal recovery of green wood to the maturation process (Annales of Science. Forestiere 51:329–338)
6. B. Clair (2012), Evidence that release of internal stress contributes to drying strains of wood (Holzforschung 66: 349–353)
7. S. Bardet, J. Gril, K. Kojiro (2012), Thermal strain of green Hinoki wood: separating the hygrothermal recovery and the reversible deformation (In “Lecture Notes in Applied and Computational Mechanics Vol.61, Mechanics, Models and Methods in Civil Engineering (Eds. Frémond, M., Maceri, F.)”, Springer-Verlag, Berlin, pp.157–162)
8. M. Tanaka, H.Yamamoto, et al. (2014), The interrelation between microfibril angle (MFA) and hygrothermal recovery in compression wood and normal wood of Sugi and Agathis (Holzforschung, in press)
9. C. Skaar (1988) Wood-Water Relations (Springer-Verlag, Berlin)
10. M. Tanaka, H. Yamamoto, et al. (in contribution), Retarded recovery of remaining growth stress in Agathis wood specimen caused by drying and subsequent re-swelling treatments
11. H.Yamamoto, Y. Kojima, et al. (2002), Origin of the biomechanical properties of wood related to the fine structure of the multi-layered cell wall (Transaction of the ASME Journal of Biomechanical Engineering 124:432-440)
12. H. Yamamoto, and T. Alméras (2007), Mathematical verification of the reinforced-matrix hypothesis by Mori-Tanaka theory (Journal of Wood Science 53: 505-509)

Monday 8 (12:20 - 12:35) ***Cédric Montero et al.***

« WOOD HYGROMECHANICS FOR STRUCTURAL TIMBER BUILDING LONGEVITY »

Cédric Montero
Laboratoire de Mécanique et Génie Civil (LMGC), University of Montpellier , France
Email: cedric.montero@um2.fr

Since always wood material have been an essential material for Human constructions. It combines good mechanical performances to resist structural actions, high adaptability by raw material transformations combined to multiple wood-based products, moderate price and a widespread renewable natural resource. With it civil engineers have always face the challenge of material selection with dedicated assembly techniques confidently enough to respect architectural design and ensure safety to the structures. But the structural longevity of wood structures is directly dependent on design and execution quality of the constructions but also on long-term mechanical performances of the constitutive wood members.

When subjected to external loading wood exhibit time-dependent behaviors, called in material science viscoelasticity at low mechanical solicitation [1-3]. This behavior differ according to solicitation orientation related to wood grain orientations [4]. For example, board subjected to flexural solicitation will mainly exhibit longitudinal phenomenons whereas timber connections will involve mainly transverse directions phenomenons. Therefore the microstructural arrangement of the polymeric components of wood is not involved on the same ways and the micromechanical interactions represent an intensive subject of research in wood material science [5-7].

In addition wood-water interactions have a major impact on this delayed response of the material [8]. Starting within the tree at green state raw material require an attentive drying procedure to be operate in construction. Then wood members continuously exchange water with the surrounding air environment. Such an interaction induces moisture content level variations influenced by temperature and internal diffusion within wood tissue [9]. It can even end up to the extreme conditions of liquid water induced by weather dew or raining and become one of the major pathology of timber structures requiring massive design efforts and craftsmen experience during construction phase to provide reliable structures.

The combination of the time-dependent behavior of wood and wood-water interaction induces unexpected mechanical response. It can for example induce large deflection level on roof purlins. This combination of low mechanical solicitation and moisture variations is called mechanosorption [10-13]. To understand the origins of this phenomenon and describe the resulting kinetics material scientists perform isolated experiments on selected wood samples through different mechanical and hygrothermal histories the evolution of the material properties are observed on a physical formalism [14-16]. In the EU countries common rules for the design of timber structures, called Eurocode 5 (EC5), have to be respected according two major criterions. First the Ultimate Limit State (ULS) lead to ensure the safety of people and structure and secondly the Serviceability Limit State (SLS) lead to ensure comfort and limited deformability of the elements [17-18]. In this standard the questions on material behaviour facing long-term actions can be discussed regarding to laboratory experiments.

This presentation will be the opportunity to present a scientist standpoint on basics knowledge of wood rheology and detail hygromechanical behaviors induced in timber structures applications.

REFERENCES:

1. Leclerc Comte de Buffon, G.-L. (1740). Expériences sur la force du bois. In Mémoires de mathématique et de physique, tirés des registres de l'Académie Royale des Sciences (pp. 453–467).
2. Grossman, P. U. A., & Kingston, R. S. T. (1954). Creep and stress relaxation in wood during bending. Australian Journal of Applied Science, 5(4), 403–417.
3. Schniewind, A. P. (1968). Recent Progress in the Study of the Rheology of Wood. Wood Science and Technology, 2, 188–206.
4. Schniewind, A. P., & Barrett, J. D. (1972). Wood as a linear orthotropic viscoelastic material. Wood Science and Technology, 6(1), 43–57. doi:10.1007/BF00351807
5. Lofty, M., El-osta, M., & Wellwood, R. W. (1972). Short-term creep as related to microfibril angle. Wood and Fiber.
6. Moriizumi, S., & Okano, T. (1978). Viscoelasticity and structure of wood. IV. Mokuzai Gakkaishi, 24(1), 1–6.
7. Navi, P., Rastogi, P., Gresse, V., & Tolou, A. (1995). Micromechanics of wood subjected to axial tension. Wood Science and Technology, 29(6). doi:10.1007/BF00194199
8. Nakano, T. (1999). Analysis of creep of wood during water adsorption based on the excitation response theory. Journal of Wood Science, 45(1), 19–23. doi:10.1007/BF00579519
9. Skaar, C. (1988). Wood-Water Relations. (S. S. in W. Science, Ed.) (p. 283).
10. Armstrong, L. D., & Kingston, R. S. T. (1960). Effect of moisture changes on creep in wood. Nature, 185(4716), 862–863.
11. Armstrong, L. D., & Christensen, G. N. (1961). Influence of moisture changes on deformation of wood under stress. Nature, 191(4791), 869–870.

12. Grossman, P. U. A., Armstrong, L. D., & Kingston, R. S. T. (1969). An assessment of research in wood rheology. Wood Science and Technology, 3, 324–328.
13. Hunt, D., & Shelton, C. F. (1987). Progress in the analysis of creep in wood during concurrent moisture changes. Journal of Materials Science, 22, 313–320.
14. Hanhijärvi, A., & Hunt, D. (1998). Experimental indication of interaction between viscoelastic and mechano-sorptive creep. Wood Science and Technology, 32, 57–70.
15. Salençon, J. (2009). Viscoélasticité pour le calcul des structures (pp. 1–147). Editions de l'Ecole Polytechnique.
16. Montero, C., Gril, J., Legeas, C., Hunt, D., & Clair, B. (2012). Influence of hygromechanical history on the longitudinal mechanosorptive creep of wood. Holzforschung, 66(6), 757–764. doi:10.1515/hf-2011-0174
17. Eurocode 5: Design of timber structures Part 1-1: General – Common rules and rules for buildings EN 1995-1-1:2004. (2004).
18. Honfi, D., Mårtensson, A., & Thelandersson, S. (2012). Reliability of beams according to Eurocodes in serviceability limit state. Engineering Structures, 35, 48–54. doi:10.1016/j.engstruct.2011.11.003

Monday 8 (12:35 - 12:50) ***Mariko Yamasaki & al.***

« MECHANICAL CONDITION OF WOOD MEMBER IN THE JAPANESE TRADITIONAL BUILDING »

M. Yamasaki, M. Uchida, T. Torichigai and Y. Sasaki
Graduate School of Bioagricultural Sciences, Nagoya University, Furocho Chikusa Nagoya 464-8601, Japan
marikoy@agr.nagoya-u.ac.jp, m.uchida@nakamurakenken.com, ysasaki@nagoya-u.jp

INTRODUCTION

In Japan, there are many large-scale old wooden buildings such as the architecture of shrines and temples. The durability of these structures is demonstrated by the existence of buildings that are more than 1300 years old, such as Horyuji Temple. These buildings are subjected to external forces of various sizes, including several disasters throughout the years. Therefore, in order to bequeath these buildings to future generations, it is important to ensure the safety of their structural mechanics.

In this study, Young's modulus of timber which was built into the old wooden structure was estimated by measuring only the stress wave propagation velocity. Young's modulus is most important practical index of mechanical property of full-scale timber. This estimation method doesn't need the measurement of density, and is based on the existing database of mechanical property of full-scale lumbers. Furthermore, the validity of estimated Young's modulus was verified by comparing the stress analyzed using 2D-FEM with this estimated Young's modulus, and the observed stress. The actual stress was obtained by measuring the strain return amount along the demolition work.

(a) Before demolition work (b) Demolition of roof frame

Fig.1: Zenkoji Daikanjin Manzen-do

MATERIALS AND METHOD

The target building is a temple of Tendai sect in Nagano City, Nagano Prefecture, named Zenkoji Daikanjin Manzendo (Fig. 1). It was built in 1894 and its roof frame was renovated from July 2010 to February 2012. Wooden members used in this roof frame were investigated. Round logs of Japanese red pine (Pinus densiflora Sieb.et Zucc.) with a cross-sectional diameter of 230 ~ 540 mm were used as roof girders.

Stress wave propagation velocities of roof members were measured before the demolition work (Fig. 2-a). The Young's moduli of all 32 roof girders and 7 roof vertical struts (6 of these were subject to strain measurement) inside the roof frame were estimated using the stress wave propagation velocity measurement prior to the demolition (2009 December). A portable resonant-type stress wave propagation timer (FAKOPP) was used for the measurement of the stress wave propagation velocity. By using the Monte Carlo simulation method based on the existing database of mechanical properties of Japanese lumbers [1], the Young's modulus, E, was estimated from the propagation velocity. The database of mechanical properties for estimation purposes is currently being accumulated in research institutes across Japan, and data for the relationship between Young's modulus of softwood lumber in full scale and its density exists. In this study, the database of "ALL" (means the database including data of all species; n = 12967) was employed [2]

(a) Measurement of Young's Modulus (b) Strain measurement

Fig.2: Measurement of mechanical condition of wood member

Preparation for the strain measurement on vertical roof struts and roof girders was carried out just prior to the demolition of the roof frame (November 2, 2010) (Fig. 2-b). The strain measurement was performed using strain gauges (Tokyo Sokki Co Ltd., PLW-60-11, Gauge length is 60 mm) via data loggers (San-ei, Logger Mate DL1200) for observing a measured value. The strain measurement points included a total of 3 points in one roof girder (ch1 ~ ch3) and a total of 9 points in 5 roof vertical struts (ch4 ~ ch12). During the demolition work (From November 2010 to February 2011), 7 times measurements in total were carried out at a frequency of about once a week.

In order to determine the weight of the roof and the roof frame, the weights of the discharged building material were measured whenever materials were carried to the disposal site. The weight measurement was accumulated on each strain measurement day.

Based on the above described measurement data, the stress state of the roof girder was analyzed using a 2D skeleton structural analysis program. In the analysis, the supporting point was assumed to be the position where a girder or a vertical roof strut touched at the lower part of the roof girder; he load point was assumed to be the position where one touched the upper roof girder or the upper vertical roof strut.

RESULTS

3.1 Young's modulus of roof member estimated by stress wave velocity

Fig. 3 shows the distributions of stress wave propagation velocity (Fig. 3-a) and Young's modulus (Fig. 3-b). The average stress wave propagation velocity of the vertical roof strut and the roof girder were 5091.3 m/s and 4897.6 m/s respectively. From these velocities, the average Young's moduli of both members were estimated to be 12.3 kN/mm^2 and 11.1 kN/mm^2 respectively. The bending Young's modulus of Japanese red pine lumber is at 5.0 ~ 10.3 ± 2.3 ~ 17.8 kN/mm^2 [3]. The Young's modulus distribution for Japanese red pine members as measured in this study is slightly larger when compared with the database, but it is still within the Young's modulus distribution range of Japanese red pine materials in general.

3.2 Estimation of Bending Stress

For the removal load at 2010.1 kN, the value that was measured when half of the wooden members forming the roof frame remained was taken as the final result for strain measurement, and the value of minimum ~ average ± standard deviation ~ maximum for the strain in the vertical roof strut was 289 ~ 361.1 ± 70.4 ~ 496 (x 10^{-6}). On the other hand, ch1 and ch3 had strains of 262 x 10^{-6} and 342 x 10^{-6} respectively; whereas ch2 had a strain of 487 x 10^{-6}. The stress acting on the members was determined from the estimated Young's modulus and these strain measurement values. The average vertical stress of the vertical roof struts was 4.4 N/mm^2; the bending stress on the strain measurement positions of the roof girder were determined to be 3.1 ~ 5.9 N/mm^2.

The 2D-FEM analysis was conducted using these estimated Young's moduli, and the analyzed stress was compared with the actual stress which was obtained by the estimated Young's modulus and strain measured along the demolition work. As a result, the order of these values matched the results from 2D-FEM analysis when it was supposed that the some joint did not work enough. In the case of a building built by using Japanese traditional construction methods such as Manzendo Temple, the intra-individual variation and the

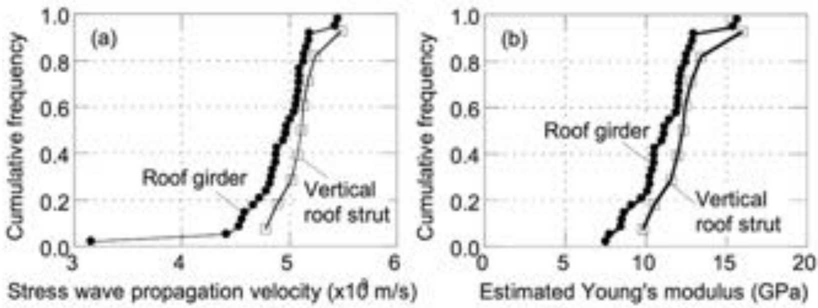


Fig.3: Distribution of Stress wave propagation velocity of frame member and estimated Young’s modulus

inter-individual variation of Young's moduli in wood members, the human-made non-uniformity during the construction and changes of the structural frame characteristics due to external forces over time are considered to be inevitable. Therefore, it is easy to assume that some deviation occurs in the building. Moreover, the estimated maximum bending stress of the roof girder was at 11.91 N/mm^2, which was 117% of the allowable stress of Japanese red pine. From this, it is suggested that there existed a stress state on the girder that was greater than or equal to the allowable stress for Japanese red pine.

<u>REFERENCES</u>:

1. M. Yamasaki, and Y. Sasaki (2010), Determining Young’s modulus of timber on the basis of a strength database and stress wave propagation velocity I: an estimation method for Young’s modulus employing Monte Carlo simulation (Journal of Wood Science, 56:269-275)
2. M. Yamasaki, Y. Sasaki and Y. Iijima (2010), Determining Young’s modulus of timber on the basis of a strength database and stress wave propagation velocity II: effect of the reference distribution database on the determination (Journal of Wood Science, 56: 380-386)
3. Forestry and Forest Products Research Institute (2005) Database of strength performance of commercial lumber (in Japanese). Database No. 7, The Institute, Ibaraki

« THE HISTORIC ROOF STRUCTURES OF THE VIENNA HOFBURG. AN INNOVATIVE INTERDISCIPLINARY APPROACH BETWEEN ARCHITECTURE AND STRUCTURAL ENGINEERING SCIENCES »

Gerold Eßer (1), Gudrun Styhler-Aydın (1), Georg Hochreiner (2)
(1): Institute of History of Art, Building Archaeology and Restoration, Vienna University of Technology
(2): Institute for Mechanics of Materials and Structures, Vienna University of Technology
Karlsplatz 13, 1040 Wien, Austria
gerold.esser@tuwien.ac.at, gudrun.styhler@tuwien.ac.at, georg.hochreiner@tuwien.ac.at

The historic roof structures of the Vienna Imperial Palace, the Hofburg, are largely unknown so far. It is since 2011 that students and staff of the Department of History of Architecture and Building Archaeology of the Vienna University of Technology are undertaking the systematic documentation and analysis of those large roof structures in cooperation with the Austrian Federal Office for the Care of Monuments and the Austrian Academy of Sciences using detailed and deformation-accurate survey methods. The outcome of the study will show exemplarily the development of large roof structures in Vienna, dating from the medieval period to the early modern and baroque eras to the 19th and 20th century (Fig. 1). Furthermore, the previous results concerning the geometry and construction history of the wooden roof structures formed the basis for material engineering and structural analysis, conducted in close collaboration between all project partners by members of the Institute for Mechanics of Materials and Structures of the Vienna University of Technology.

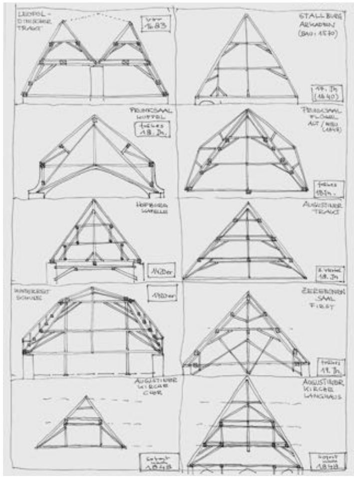


Fig. 1: Typology of roof structures

The basis for the historical analysis of the roof structures is the contour-accurate survey and detailed documentation. The survey data are also used for the classification and dating of the structures. Here, the results gave the opportunity to reconstructing and describing in a comprehensible way the construction process including secondary adaptions. Thus, deformations that have occurred can be interpreted on the one hand as growth characteristics and mechano-sorptic processes specific to the material. On the other hand they can be taken as the reaction of the real load bearing characteristics of the roof structures.

Fig. 2: Roofing structure (Michaelerkirche)

An innovative part of the project is the ongoing mutual exchange between all partners concerning the results of various analyses. Thus, the interdisciplinary methodology allows an extended view on the development of historic roof structures in Austria and Germany.

Through extension of the methodology into engineering matters by structural assessment the knowledge base of the structures is considerably broadened. Since historical roof-structures made of solid timber are sometimes very complex with respect to geometry, connectors and the conservation status of the material the software for the structural analysis needs to fulfil several criteria: Facilities for nonlinearities, arbitrary slip-curves for connectors, stability-check, beam-, plate- and volume-elements for modelling, different material models, powerful visualisation tools. For this purpose not only scientific but also commercial structural simulation software can be used. The modelling includes the original geometry and setup of connectors including dedicated imperfections, but no elastic respective plastic displacements or crack formation. They are back-calculated iteratively from the 3-dimensional structural model (Fig. 2) and have to be validated by the extensive visual documentation. Sometimes this iterative process needs more cycles for the identification of alternative structural systems in case of intermediate local fracture of over-stressed members or connections (Fig. 3).

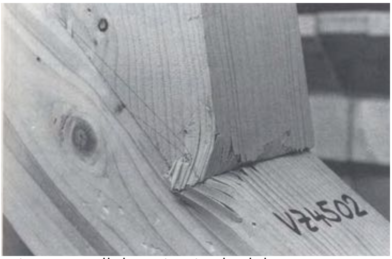


Fig. 3: Parallel testing in the laboratory

The benefits of such a complementary structural assessment are multifarious: Certainty about the correct functionality of the very first layout, changes of the structural behaviour induced by degradation (e.g. moisture and fungi), the efficiency of reinforcements later on, safety level of the present structure and the possibilities for additional loading in the future e.g. induced by visitors.

The mechanical analysis of such roof-structure in detail and the history of techniques provide deep insight into the development of expertise of wood craftsmen with respect to engineering aspects. Well-founded recommendations can be given for a sustainable conservation of the monument based on the deep knowledge about the material (=timber) itself and its structural behaviour. Further important information of these mechanical assessments can be used in future activities to preserve the historic roof structures aiming at minimal and sustainable structural interventions and respecting the original technology, which meets current guidelines for the protection of monuments.

REFERENCES:

Articles and book contributions

G. ESSER and G. Styhler-Aydın (in print), Das mittelalterliche Dachwerk der Hofburgkapelle in Wien. Forschungen zur Baugeschichte (M. Schwarz, Die Wiener Hofburg im Mittelalter), international peer review, about 20p.

G. ESSER and G. Styhler-Aydın (in print), Das spätmittelalterliche Dachwerk der Michaelerkirche in Wien. Forschungen zur Baugeschichte (M. Schwarz, Die Wiener Hofburg im Mittelalter), international peer review, about 15p.

G. Hochreiner, J. Füssl and J. Eberhardsteiner (2014), Cross-laminated Timber Plates Subjected to Concentrated Loading Experimental - Identification of Failure Mechanisms (Strain, 50:1:68-81).

G. Hochreiner, J. Füssl, J. Serrano and J. Eberhardsteiner (2014), Influence of wooden board strength class on the performance of cross laminated timber plates investigated by means of full-field deformation measurements” (Strain, 50:2:161-173).

G. Hochreiner, T. Bader, K. de Borst and J. Eberhardsteiner (2013) Stiftförmige Verbindungsmittel im EC5 und baustatische Modellbildung mittels kommerzieller Statiksoftware (Bauingenieur, 88:275-289).

G. Hochreiner, T. Bader, K. de Borst, J. Eberhardsteiner (2013) Stiftförmige Verbindungsmittel im EC5 und baustatische Modellbildung mittels kommerzieller Statiksoftware (Bauingenieur, 88:275-289).

Talks, attendance at congresses and guided tours

G. ESSER, H.A. Liebich and G. Styhler-Aydın (2013), Die Dächer der Wiener Hofburg, Forschungen der Technischen Universität Wien zur Baugeschichte (curators of exebition on students works in building survey and building archaeology of the years 2011 to 2013 as well as public guided tours to the Vienna Hofburg trusses, Vienna Hofburg, National Monument Day, 29-09-2013).

G. ESSER and T. BADER (2013), Die Dachwerke der Wiener Hofburg: Hofburgkapelle, Schweizertrakt und Winterreitschule, (guided tour to the Austrian Society for Engineers and Architects/ÖIAV. 26-09-2013).

G. ESSER (2013), Preservation, building survey and inventory, documentation and recording of historic architecture: Timber Roof structures at Vienna Imperial Palace (lecture at Vienna International Summer School - Austrian Architectural Culture / VISS-AAC, INNES Vienna, 10-07-2013).

G. ESSER (2013), Baugeschichtliche Einführung in die Dachwerke der Hofburg und innovative Methoden der Bauaufnahme (invited lecture at Vienna University of Technology, Institute for Mechanics of Materials and Structures, 12-06-2013).
G. ESSER (2013), Historische Dachkonstruktionen Mitteleuropas. Geometrische Erfassung, bautechnische Analyse, Typengenese (invited lecture at Vienna University of Technology, Department of Architectural Sciences, Structural Design and Timber Engineering, 15-05-2013).
G. ESSER (2013), „Die Dachwerke der Wiener Hofburg. Forschungen der Technischen Universität – Hofburgkapelle und Michaelerkirche“ (curator of talks with own contribution „Die Dachwerke der Hofburg: Ein Projekt in Lehre und Forschung der Technischen Universität Wien – Versuch einer baugenetischen Einordnung“, Vienna Hofburg, 27-02-2013).
G. ESSER, H.A. Liebich and G. Styhler-Aydın (2012), Die Dächer der Wiener Hofburg, Forschungen der Technischen Universität Wien zur Baugeschichte, (curators of exebition on students works in building survey and building archaeology of the years 2011 and 2012 as well as public guided tours to the Vienna Hofburg trusses, Vienna Hofburg, National Monument Day, 30-09-2012).
G. ESSER (2012) Räumliche Erfassung und bautechnische Analyse historischer Dachtragwerke, (invited lecture at Technical University of Graz, Institute of Timber Engineering and Wood Technology / LIGNUM, 12-07-2012).
G. Hochreiner (2011), Plastizität im Ingenieurholzbau - Baustatische Modellbildung an ausgewählten Beispielen“ (invited talk at Baustatik-Baupraxis 11, Innsbruck, Austria, 21.02.2011-22.02.2011).

Tuesday 9 (10:00 - 10:15) ***Naoko Matsuzyama***

« SAFEGUARDING TRADITIONAL CRAFTSMANSHIP AS INTANGIBLE HERITAGE OF JAPAN »

Naoko MATSUYAMA
Department of Intangible Cultural Heritage, National Research Institute for Cultural Properties, Tokyo
13-43 Ueno Park, Taito-ku, Tokyo 110-8713 JAPAN
n.matsuyama@tobunken.go.jp

Japan is an island country with many mountains, which stretches from Sea of Okhotsk in the North to East China Sea in the South located in East Asia. Strong transformation of the environment that appears in four distinct seasons brings rich natural resources including various types of trees. Utilizing indigenous trees, variety of wooden crafts were made and developed in line with the times and demand, along with the development of its technique, such as joinery, turnery, inlaid wood work and etc. Not only wooden crafts, but also many other domains of craft, such as ceramics, textile, metalwork, paper making, and etc. has been developing in the same manner.

The traditional craftsmanship, that some are considered to be intangible cultural heritage (hereinafter referred to as "ICH") of Japan. ICH and the associated techniques started to be safeguarded more than half a century ago, when we faced the threat of extinction due to social changes. Not only traditional craftsmanship, but also knowledge and techniques that have been succeeded from generation to generation, such as Kabuki, Nohgaku, folk performing arts are also known as ICH, as well as the techniques for the production of materials, restoration and conservation necessary for the preservation of cultural property. In order to protect precious cultural heritage succeeded from our ancestors, the Law for the Protection of Cultural Properties was enacted in 1950. Since then, the Law has undergone several amendments to become what it is today. The purpose of the present law is to preserve and utilize cultural property objects so that the cultural quality of the nation can be enhanced, thereby contributing to the evolution of world culture[1]. In current law, ICH are classified into the following 3 categories; Important Intangible Cultural Property (hereinafter referred to as "IICP"), Important Intangible Folk Cultural Property (hereinafter referred to as "IIFCP"), and Selected Conservation Techniques (hereinafter referred to as "SCT"). The skill holders or the skill holding groups of the designated or selected items have mission to continue to transmit the skill to the next generation, yet to develop their own creative activity. Each category of cultural properties are recognized and designated according to the nature of the items and the criteria.

The definition of Intangible Cultural Properties by law is; Drama, music, applied art, and other intangible cultural products that are of a significant historical or artistic value to Japan[2]. For the Intangible Folk Cultural Properties, it is defined as manners and customs related to food, clothing, and housing, to occupations, to religious faiths, and annual festivals, as well as performing arts and folk skills[3]. The SCT are traditional techniques or craftsmanship for the production of materials, restoration and conservation, that are indispensable to the preservation of cultural property[4]. The skill holder of IICP is so called 'Living National Treasure'. Beside the national inventories, 47 Prefectures, and approximately 1,740 Cities, Towns, and Villages exist throughout Japan has their own inventories. These inventories are made according to the national Law for the Protection of Cultural Properties. The number of designated properties of these levels is 654 for ICP, 7,873 for IFCP, and 59 for SCT (as of May, 2013). These inventories are individually managed and maintained by each local area.

On another front, the efforts to promote traditional crafts industries are made along different stream. Traditional craftsmanship by its nature, that has been developed within the people's everyday life, the craft products should be sold to have better circulation of getting raw material, creation, production, promotion, nurturing trainee, maintain the living, and etc. For the purpose to strengthen national economy development, the Law for the Promotion of Traditional Crafts Industries was enacted in the year 1974, aims to promote traditional crafts industry, as well as to enrich nation's life and contribute to the development of local economy. Currently there are 218 craft items designated and 4,280 traditional craftsmen are designated under this law(as of February, 2014).

The paper and presentation will focus on the current effort of safeguarding traditional craftsmanship as ICH of Japan, based on the Law for the Protection of Cultural Property. It will share the experience of Japanese safeguarding system and various activities to promote safeguarding ICH.

Looking at nationally designated wooden craft related items, there are 17 items out of 104 IICP items, which 16 out of that are individual craftsman(Moku-kougei(木工芸) 5 individuals, Chiku-kougei(竹工芸) 2 individuals, Lacquerwork Makie （蒔絵）2 individuals, Lacquerwork Raden （螺鈿）1 individual, Lacquerwork Kinma （蒟醤）2 individuals, and Lacquerwork Kyusitsu （髹漆）3 individuals)[5] and 1 is skill holding group(Wajima-nuri（輪島塗）)[6]. For SCT, there are 13 items out of 75 related to wooden crafts, which 7 are individual craftsman(Woodworking Techniques for Structures （建造物木工）, Cypress Bark Roofing and Wooden Shingle Roofing（檜皮葺・杮葺）, Production and Restoration of Noh-kan (flutes for Nohgaku theater) （能管製作修理）, Restoration of Lacquerware （漆工品修理）, Restoration of Woodwork （木工品修理）, Production and Restoration of Biwa (Japanese stringed instrument) （琵琶製作修理）, Production of Wooden Shingle (Yaneita) （屋根板製作）)[7] and the rest are the skill holding groups(Restoration Techniques for Wooden Statues（木造彫刻修理）, Architectural conservation （建造物修理）, Woodworking Techniques for Structures （建造物木工）, Cypress Bark Roofing and Wooden Shingle Roofing （檜皮葺・杮葺）, Production and Refinement of Urushi (Lacquer) （日本産漆生産・精製）, Wood Print Techniques for Ukiyoe （浮世絵木版画技術）)[8].

The national government provides 2,000,000 JPY as annual subsidiary to individual skill holders of IICP, for the purpose of polishing their skills and to train successors. The government also supports training projects and public performances to skill holding groups and local governments. Also, various efforts are made to preserve the ICH into tangible format, such as producing audio-visual documentary film of skill holders and introducing basic information of traditional craftsmanship online.

Japanese safeguarding system of ICH has contributed in the creation of the Convention for the Safeguarding Intangible Cultural Heritage of Humanity, which was adopted in 2003 from UNESCO. Now, the state parties to the Convention are 160 states as of 15 May, 2014. As the time goes by, as it is "intangible" cultural heritage, it is important to constantly research current situation from various point of view and re-examine better ways of safeguarding. What is "Traditional Craftsmanship"? How do we understand and accept the change of tradition and natural environment? The paper and presentation will also share the challenges of Japanese situation.

REFERENCES:

1. Chapter I General Rules, Article 1: Purpose of the Present Law, Law for the Protection of Cultural Property
2. Chapter I General Rules, Article 2: Definition of Cultural Property (2), Law for the Protection of Cultural Property
3. Chapter I General Rules, Article 2: Definition of Cultural Property (3), Law for the Protection of Cultural Property
4. Chapter X Protection of Preservation Techniques for Cultural Property, Article 147: Selection of Preservation Technique, Law for the Protection of Cultural Property

5-8. Hirotsugu SAITO, Migiwa IMAISHI, Naoko MATSUYAMA, Masaki SANO (2013), Intangible Cultural Herigtage Safeguarding Efforts in Japan (International Information and Networking Centre for Intangible Cultural Heritage in the Asia-Pacific Region under the auspices of UNESCO

Tuesday 9 (10:15 - 10:30) ***Catherine Lavier et al.***

« ARCHEODENDROMETRICAL APPROACHES OF A SHINTO-BUDDHIST SULPTURE »

C.Lavier, T.Mitsutani, E. Daniel and V. Asensi Amoròs
LAMS - Laboratoire d'Archéologie Moléculaire et Structurale
Sorbonne universités, UPMC - Université Pierre et Marie Curie, Paris-6, UMR 8220 : CNRS et UPMC
PARIS, France
In collaboration with Mechtild Mertz
Catherine.lavier@upmc.fr, takumi@nabuken.go.jp, emmadanielpro@gmail.com, victoria.asensi@free.fr

During a work concerning the study and the preservation-restoration of a Shinto-Buddhist sculpture, of 49x44x42 cm (which could represent a deity, Fig.1) stored in France [1], the numerous gaps of polychromy could allow an analysis of the support wood according to the archaeodendrometrical methods respecting the integrity of the work [2]. The examination was to define the homogeneity of this set consisted of numerous wooden fragments, to determine the species, to specify the dating and the origin of the woods and to interpret the results.

Two trees seem to have been used: Cryptomeria japonica (Sugi) and Chamaecyparis obtusa (Hinoki). The dendro-chronological measurements made on the elements of Hinoki indicate that fragments were extracted from the same tree, probably of more than 3 centuries and the most recent and preserved tree rings take place at the beginning of the XVIth century. But for diverse reasons which we shall explain, the date of cutting down took place from the end of the XVIth century that is to say the initial phase of Edo period. The forest origin of wood is biogeographically similar to chronologies established for the region of Nagano, Japan.

This current study, led jointly between France and Japan, will continue by additional xylometrical studies [3] to pull the maximum of information.

(FRENCH VERSION) :

Lors d'un travail de mémoire portant sur l'étude et la conservation-restauration d'une sculpture shinto-bouddhique de 49x44x42 cm (qui pourrait représenter une déité, Fig.1) conservée en France [1], il s'est avéré que les nombreuses lacunes de polychromie pouvaient permettre une analyse du support bois selon les méthodes archéodendrométriques respectant l'intégrité de l'œuvre [2]. L'examen avait pour but de définir l'homogénéité de cet ensemble composé de nombreux fragments de bois, d'en déterminer les essences, d'en préciser la datation et l'origine des bois constitutifs et d'en interpréter les résultats.

Deux arbres semblent avoir été employés : Cryptomeria japonica (Sugi) et Chamaecyparis obtusa, (Hinoki). Les mesures dendrochronologiques faites sur les éléments de Hinoki indiquent que les fragments sont extraits du même arbre, probablement âgé de plus de 3 siècles et les cernes les plus récents conservés se placent au début du XVIe siècle. Mais pour diverses raisons que nous exposerons, la date d'abattage a eu lieu à partir de la fin du XVIe siècle soit en phase initiale de la période Edo. L'origine forestière des bois est biogéographiquement semblable aux chronologies établies pour la région de Nagano, Japon.

Cette étude en cours, menée conjointement entre France et Japon, se poursuivra par des études xylométriques [3] complémentaires afin d'en tirer le maximum d'informations.

REFERENCES:

1. E. Daniel (2013), Etude et Conservation-Restauration d'une sculpture en bois polychrome, d'origine japonaise, début de la période Edo, mémoire de fin d'études de l'Ecole de l'Atelier du temps Passé, Paris, 206 p.
2. C. Lavier (2013), CRI 2013-05-12, 16 p.
3. V. Asensi Amoròs, C. Lavier, E. Daniel, T. Mitsutani (2013) Study, conservation and restauration of an Edo period Shinto sculptur. Current results of archaeodendrometricam approaches, International Wood Culture Symposium on Taxodiaceae, Changsa, China, October 25-27, 2013

Tuesday 9 (10:30 - 10:45) ***Magali Toriti et al.***

« THE CONDITION OF WOOD WORKED OF ANTIQUITY: ARCHEOLOGICAL, ENTOMOLOGICAL AND ANTHROPOLOGICAL APPROCHES »

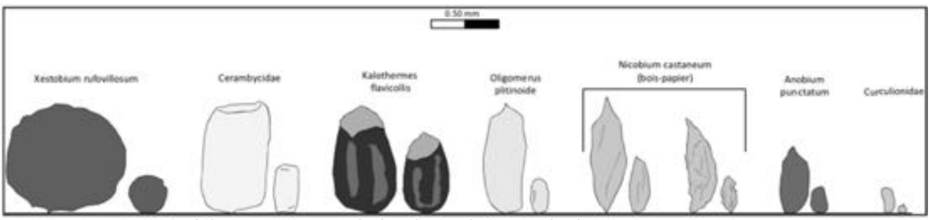
« L'ETAT SANITAIRE DES BOIS OUVRAGÉS DE L'ANTIQUITÉ : APPROCHES ARCHÉOLOGIQUE, ANTHRACOLOGIQUE ET ENTOMOLOGIQUE »

Magali Toriti (1) ; Fabien Forher (2) ; Aline Durand (1)
(1): Université du Maine CreAAH UMR 6566,
(2): Centre Interrégional de Conservation et de Restauration du Patrimoine (Belle de Mai, Marseille)
mag.toriti@gmail.com

The wood, especially the worked, is susceptible to be attacked by woodborers insects and wood-destroying fungi.

The studied Gallo-Roman wood, from first to the third century AD, have been discovered in various archaeological sites of the south-eastern of France, appearing as flooring, door, collapsed and charred lintel. This archaeological context preserve traces of wood pests have been preserved: tunnels, charred woodworm, remains of elytra and wood deformations.

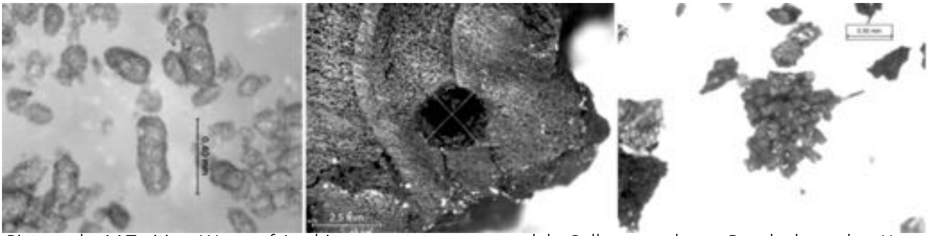
A new method is being implemented with the objective of determining family and species of these insects. These experimental protocols will be presented. Gradually, the presented method allows a better understanding of wood condition, as it was before carbonization and abandonment of habitat. Moreover, It



Representation of the various worm holes depending on xylophagous species, DAO M. Toriti, 2014 is useful to restore and to have a better understanding of mechanical properties and their alterations face these attacks. It also allows to see if ancient societies treated or not their engineered wood (smoking, application of pitch, etc.).

Each woodborers insect, or family, forms a characteristic woodworm.

A current wood database have been created and enriched by measuring worm holes and observing their form to discriminate the xylophagous insects and lead to a specific determination.
Each species lives in its own bio-ecological environnement and presents its own characteristics. Confronting archaeological data (location of pieces of wood, cutting, implementation, source of close humidity), entomological observations (colonizing species, proportions) and anthracological identifications (woody species in question), can restitute the structure and its condition, frozen by the fire at a specific time, is outlining.



Pictures by M.Toriti: a. Worm of Anobium punctatum on wood. b. Gallery on a beam Beech charred. c. Heap of charred worm holes

The application on wood-charcoal also appears to function as compared with the repository. Two floors located in Roman habitats will be presented.

- The floor, US 3775 Roman urban street, Camelin, Fréjus (83).

This is a slightly raised floor (crawl underneath with a trough) has been discovered in a storage room as primarily function, decorated by painted coatings. More than 27 wooden elements compose this structure: Beech, Fir and Aleppo pine. Each of these woods is affected by various species of woodborers and by a cubic mold (fungus). Details will be explained.

- The floor, US 3095, rural mountain site, Col Adon, Mujouls (06)

In a small Gallo-Roman house situated at 1000m, the Scots pine floor is stuffed with insect tunnels and small worm holes beetles. Spatialization and measures of colonizing populations proportions offer a vision of the progress of these insects.

(FRENCH VERSION)

Le bois, en particulier le bois ouvragé, est sensible aux attaques d’insectes xylophages et de champignons lignivores.

Les bois gallo-romains étudiés, du I^{er} au III^{e} siècle après J.-C., ont été mis au jour sur divers sites de fouilles archéologiques du Sud-Est de la France, apparaissant sous forme de plancher, porte, linteau… effondrés et carbonisés. C’est en raison de ce contexte que les traces des ravageurs du bois ont été préservées : galeries, vermoulures carbonisées, restes d’élytres et déformations du bois.

Une méthode inédite est en cours de mise en œuvre ayant pour objectif de déterminer, parfois à l’espèce, ces ravageurs. Une présentation des protocoles d’expérimentations est prévue. De fil en aiguille, la méthode présentée permet de mieux appréhender l’état du bois, tel qui l’était au moment de son fonctionnement (avant la carbonisation et l’abandon de l’habitat). De même qu’elle peut restituer les propriétés mécaniques et leurs altérations face à ces attaques, ou encore de percevoir si les sociétés anciennes traitaient ou non leurs bois ouvragés (par le fumage, l’application de poix, etc.).

Chaque insecte xylophage, ou famille, forme une vermoulure caractéristique.

Un référentiel sur bois actuel est en cours de création. La mesure de vermoulures et l’observation de leur forme permet d’identifier le xylophage concerné.

Chaque espèce possède une bio-écologie et des caractéristiques qui lui sont propres. En confrontant les données archéologiques (emplacement des pièces de bois, débitage, mise en œuvre, source d'humidité proche), entomologiques (espèces colonisatrices, proportions) et anthracologiques (essences ligneuses en cause) une restitution de la structure et de son état, figé par l'incendie à un instant précis, se dessine.

L'application sur charbon de bois semble fonctionner également, par comparaison avec le référentiel. Deux planchers situés dans des habitats seront présentés.

- Le cas du plancher, US 3775, Site urbain de la rue Camelin, Fréjus (83).

Il s'agit d'un plancher légèrement surélevé (vide-sanitaire dessous avec un caniveau) situé dans une pièce à fonction de stockage principalement, décorée d'enduits peints. Pas moins de 27 éléments en bois compose cette structure : en Hêtre, Pin d'Alep et Sapin. Chacune de ses essences est touchée par différentes espèces de xylophage ainsi que par une pourriture cubique (champignon). Les détails seront expliqués.

- Le cas du plancher, US 3095, Site rural d'altitude du Col d'Adon, Les Mujouls (06)

Dans une petite habitation gallo-romaine située à 1000m d'altitude, un plancher entièrement en Pin de type sylvestre arbore de nombreuses galeries et vermoulures de petites vrillettes. La spatialisation et les mesures de proportions des populations colonisatrices proposent une vision de la progression de ces ravageurs.

REFERENCES:

Adam J.-P. 1989 – La construction romaine : matériaux et techniques. Paris, éd. Picard, deuxième édition, 1989, 367 p.

Beal J.-C. 1995 - L'arbre et la forêt, le bois dans l'antiquité. Paris, éd. de Boccard, bibliothèque Salomon-Reinach), 115 p.

Bernardi Ph. dir 2007. - Forêts alpines et charpentes de Méditerranée. Gap, éd. du Fournel, 2007, Exposition créée au musée muséum départementale, en partenariat avec la région Provence-Alpes-Côte-d'Azur et le Laboratoire d'Archéologie Médiévale Méditerranéenne (LAMM), pp. 9-190.

Chabal L. 1997 - Forêts et sociétés en Languedoc (Néolithique final, Antiquité tardive), l'anthracologie, méthode et paléoécologie. Paris, Documents d'archéologie française, 63, 189 p.

CTBA 1996 : Centre Technique du Bois et de l'Ameublement – Le traitement curatif des bois dans la construction. Département BIOTEC (Biologie, Environnement, Technologies). Paris, éd. Eyrolles, CTBA, 140 p.

Lepesme P. 1944 – Les coléoptères, des denrées alimentaires et des produits industriels entreposés. Paris, éd. Paul Lechevalier, 124 p.

Marcadé J. 1974 –Le bois dans l'archéologie, l'architecture antique et le bois, le commerce et le travail du bois, la sculpture du bois, l'ébénisterie égyptienne. Genève, Paris, Munich, éd. Nagel, 64 p.

Moskal-del Hoyo et al. 2010 - MOSKAL-DEL HOYO (M.),WACHOWIAK (M.), BLANCHETTE (R.A.) - Preservation of fungi in archaeological charcoal. Journal of Achaeological Science, 37, 2010, pp. 2106-2116.

Noël M., Bocquet A. 1987 – Les hommes et le bois. Histoire et technologie du bois de la Préhistoire à nos jours. Poitiers, éd. Hachette, 347 p.

« THE COMBINED INFLUENCE OF VARYING MICROFIBRIL ANGLE AND MOISTURE CONTENT ON THE TENSILE STIFFNESS OF SINGLE SPRUCE FIBRES »

A. Friederike Saxe[1]*, B. Michael Dürfeld[1]*, C. Wolfgang Schäffner[1], Clemens von Schoeler[1], and D. Peter Fratzl[1,2]
* equal contribution
(1): Image Knowledge Gestaltung. An Interdisciplinary Laboratory,
Cluster of Excellence Humboldt-Universität zu Berlin, Sophienstrasse 22a, 10178 Berlin, Germany
(2): Department of Biomaterials, Max Planck Institute of Colloids and Interfaces, 14424 Potsdam, Germany
Friederike.Saxe@mpikg.mpg.de, Michael.Duerfeld@hu-berlin.de,
Schaeffner@culture.hu-berlin.de, clemens.von.schoeler@gmx.de, Peter.Fratzl@mpikg.mpg.de

"Historical Structural Investigations in the Laboratory" is a project of the Cluster of Excellence "Image Knowledge Gestaltung. An interdisciplinary Laboratory" at the Humboldt Universität zu Berlin. This interdisciplinary laboratory is a union of social, natural and engineering sciences, medicine and also includes the disciplines of design and architecture. The goal of bringing these more than 25 different disciplines together is to investigate fundamental aspects of the process of Gestaltung in all areas of science and humanities.

The project "Historical Structural Investigations in the Laboratory" is based on the fact that, although (descriptive) structural research on whole organisms was extremely important and conducted on a very high level in the natural sciences between 1870 and 1930, its results have since disappeared from the typical scope of the laboratory. This knowledge, however, is critical for some areas in modern science and engineering where solutions to technical problems found by organisms in the course of evolution are studied as potential models for engineering solutions. Hence, the project seeks to connect historically oriented structural research with laboratory research. The aim is to investigate not only historical biological literature and images but also historical objects and practices.

Indeed, natural materials serve as a reservoir of ideas and concepts that can be applied for innovations in science, technology and design. We are currently developing a data base of historical literature containing descriptions of a broad range of organisms that have not been in the focus of current laboratory work, yet might have evolved valuable mechanisms and material designs for present requirements. In addition, we are developing tools to classify and search such data. Besides natural model systems, the knowledge about old practices can complement the quantitative knowledge obtained by scientific research and we are approaching this issue in our project through the example of wood. An interdisciplinary team of craftsmen, wood scientists, architects, biologists, cultural scientists, ethnologists and historians is starting to explore the possibilities of making such practices available and searchable for a broad audience.

As a practical outcome, we are developing a structure-function-ontology as the basis of a digital platform that allows searching through historical literature and images. A further goal is to complement this by the possibility of searching through a set of objects in the museum (e.g. of natural history in Berlin) as well as through a collection of wood manufacturing practices.

« THE COMBINED INFLUENCE OF VARYING MICROFIBRIL ANGLE AND MOISTURE CONTENT ON THE TENSILE STIFFNESS OF SINGLE SPRUCE FIBRES »

A. Nils Horbelt, B. Michaela Eder and C. Peter Fratzl
Department of Biomaterials,
Max Planck Institute of Colloids and Interfaces, 14424 Potsdam, Germany
Nils.Horbelt@mpikg.mpg.de, Michaela.Eder@mpikg.mpg.de, Peter.Fratzl@mpikg.mpg.de

Working with the material wood is a challenge both for craftsmen, technologists and scientists. Difficulties often arise due to heterogeneous properties – mainly caused by natural variability. Besides varying wood density, the structural properties of wood cell walls are crucial for the mechanical performance of wood. It is well known, that large microfibril angles (MFA) of the dominant S2-layer in the wood cell walls lead to a lower tensile stiffness [1]. In addition moist wood is less stiff than dry wood [2]. Data from previous studies [3,4] suppose that the reduction in tensile stiffness with increasing moisture content is much stronger for compression wood fibres with a typically high MFA than for adult wood fibres with a typically low MFA. So far no systematic study that deals with this combined influence has been done. The aim of our work was to create an experimental data set on the tensile stiffness as a function of the MFA and the moisture content to get a better understanding of structure-property relationships of the wood cell wall.

For this we selected different tissues of Norway spruce (Picea abies [L.] Karst.) and measured the MFA by using X-ray diffraction. Four different tissues with MFAs ranging from ~10 – 40° were used for single fibre isolation. The fibres were mechanically isolated with fine tweezers to preserve the cell wall in an unmodified state [5] and then mounted in a custom built tensile tester which allows controlling relative humidity next to the sample. After the sample has reached an equilibrium state the fibres were strained in tension until failure. The effect of changing moisture contents on the tensile stiffness was minor for fibres with low MFA but very large for fibres with high MFAs. The obtained data was used to verify a mechanical model that allows the prediction of tensile stiffness for varying microfibril angles and changing moisture contents.

REFERENCES:
1. A. Reiterer, H. C. Lichtenegger, S. Stanzl-Tschegg, P. Fratzl (1999), Experimental evidence for a mechanical function of the cellulose microfibril angle in wood cell walls (Philosophical Magazine A, 79:9:2173-2184)
2. P. Niemz (1993), Physik des Holzes und der Holzwerkstoffe (DRW-Verlag, Leinfeld-Echterdingen), 234p.
3. P. C. Kersevage (1973), Moisture content effect on tensile properties of individual Douglas-fir latewood tracheids (Wood and Fiber Science, 5:2:105-117)
4. M. Sedighi-Gilani, P. Navi (2007) Experimental observations and micromechanical modeling of successive-damaging phenomenon in wood cells' tensile behavior (Wood Science and Technology, 41:1:69-85)
5. I. Burgert, N. Gierlinger, T. Zimmermann (2005) Properties of chemically and mechanically isolated fibres of spruce (Picea abies) [L.] Karst.). Part 1: Structural and chemical characterization (Holzforschung, 59:2:240-246)

Tuesday 9 (10:55 - 11:00) **Siham Amirou & al.**

« BIO-PARTICLEBOARDS FROM DATE PALM TRUNK »

S. AMIROU[1], A. ZERIZER[1] and A. PIZZI[2]
(1): UR-MPE, FSI, UMBB, 35000 Independence Avenue of Boumerdes, Algeria
(2): LERMAB, ENSTIB, University of Lorraine, Epinal, France
Amirou.siham@gmail.com

Date palm trunk is a renewable natural resource that has not an industrial utilization yet. The objective of this work was to evaluate properties of experimental particleboard panels manufactured from date palm trunk and naturals adhesives. Modulus of rupture (MOR), modulus of elasticity (MOE) and internal bond (IB) of the samples were tested based on European Standards. For this study, particleboards were produced using date palm trunks as an alternative raw material for the forest products industry. Two natural resins types were used: (1) commercial mimosa flavonoid tannin extract with 6% hexamine added as hardener and (2) a mix of mimosa tannin + hexamine with glyoxalated lignin of low molecular weight, these two resins mixed with different percentages by solids content weight. The particleboard was shown to pass the relevant interior standards with such adhesive formulations except the formulation tannin/hexamine+ glyoxalated lignin 50/50. The findings indicated that date palm trunk waste is a valuable renewable natural resource for particleboard production and could be utilized as a substitute for wood in board production with naturals adhesives.

Tuesday 9 (11:00 - 11:05) **Nima Saedlou**

« USE AND WOODCRAFT IN THE IRON AGE TIME THROUGH AN UNUSUAL CORPUS OF TRÉGUEUX (CÔTE D'ARMOR) »

N.Saedlou
Laboratory Xylotree, 31 rue des santones, 17100 Saintes
xylotree@gmail.com

An unusual corpus of 716 waterlogged wood objects were found in the archeological excavation of Trégueux (Côtes d'Armor, France). A large majority of them are dated of the Iron Age and 90% are manufactured.

Each wooden piece has been studied :

- macroscopically by mentioning dimensions, typology, tracks of tools and fungi or xylophage attacks.
- microscopically following the 3 anatomical plans (cross, tangential and radial) to identify the species.

Fig.1: Object n°2357 looks like assembly dowel, photo Oxford Archéologie

Many objects belonging to the same typology (like containers) provide us a better understanding of their use. Majority of the objects is related to feeding and more specifically storage or transport of food (solid and/or liquid) like a high number of small staves (around 200), lids (around 27), bottoms (around 42) and handles (around 3).

Other objects are used for culinary art were also found out: dough trough, mortar and pestle and two parts of a same small container.

A series of 46 objects is probably assembly dowels (fig.1). Their shape is similar and follows the same pattern: a "head" that could be rectangular or pyramid-shape and a flat "body" with mostly a mortise in the center.

Presence of some remarkable objects are to be highlighted as a sculptured head of animal (fig.2).

Ten different species were identified by xylologic analysis, classified by decreasing quantity: oak (Quercus pedunculata or Quercus petraea), yew (Taxus baccata), elderberry (Sambucus nigra), ash (Fraxinus excelsior), hazel (Corylus avellana), rosaceae genus pomoïdée, papilionaceae, willow (Salix sp.), maple (Acer campestre), alder (Alnus glutinosa).

Widely used for the manufacturing of buckets (37 %) and in particular those which are beautifully crafted, the yew selection as based material let us confused. Indeed, this choice is singular because its leaves, twigs, seed and wood contain a highly toxic alkaloid for the man and most of the animals, the taxine whose narcotic and paralysing effects are not dissipated neither by dehydration nor by boiling. Furthermore, working the yew would expose craftsmen to violent headaches [1].

By typological and traceological analyses the bowls were classified among buckets, kegs or barrels following the diameter of lids and funds or size of staves. Some are very beautiful crafted while others underwent re-use:

- supernumerary holes of dowel whose some do not serve anymore,
- stave with double crozes,
- holes of dowels badly placed (at the level of the croze).

The characterization marks of tools on numerous objects led to emit some hypotheses on the tools which were used by the craftsmen of this period.

Wood pieces of Trégueux constitute an exceptional corpus by both its quantity and quality: objects are splendidly preserved and make a significant contribution to our knowledge of man and wood relation in the Iron Age.

Fig.2: Object n°2088 representing an animal mouth, photo N.Saedlou

REFERENCES:

1 . P. Lieutaghi (2004), Le livres des arbres, arbustes et arbrisseaux, (Actes Sud, Paris), 1322p.

Tuesday 9 (12:20 - 12:35) **Aoi Hirano & al.**

« DEVELOPMENT OF FLEXIBLE WOODEN COMPOSITE USING COMPRESSED WOOD »

Aoi Hirano[1], Nozomi Takemura[1], Eiichi Obataya[1], and Koji Adachi[2]

[1] Graduate School of Life and Environmental Science, University of Tsukuba, Ibaraki 305-8572, Japan

[2] Institute of Wood Science and Technology, Akita Prefectural University, Akita, 016-0876, Japan

tororoaoi9045@gmail.com, obataya.eiichi.fu@u.tsukuba.ac.jp

INTRODUCTION:

When a wood is completely compressed in its radial (R) or tangential (T) direction, it becomes hard, rigid and strong material. On the other hand, when a wood is moderately compressed, it can deform softly and elastically under compressive loading because the folded cell walls act as flat springs. Such a softness and elasticity of compressed wood can expand the possibility of wood-based material. In this paper, we describe unique compressive behavior of compressed wood, and then we introduce the excellent flexibility and toughness of a composite beam consisting of compressed wood.

MATERIALS AND METHODS:

Cubic samples, 10-15 mm on each side, were made by Japanese cedar wood (Cryptomeria japonica D.Don). Its air-dry density was 359 kg/m^3. Those cubes were compressed in their R direction at 2 mm/min. The loading and unloading were repeated three times to observe elastic recovery of deformation.

Meanwhile we made a composite beam using the compressed wood. Figure 1 exhibits the structure of the composite beam (CR+CL). Cedar wood blocks were compressed by 50% in their R direction and then laminated along the R direction. That laminated beam (CR) was used in the inner part of the composite beam. On the other hand, cedar lumber was compressed by 70% in its R direction and the compressed plate (CL) was used for the outer part as its fiber direction is aligned to the longitudinal direction of the beam. The dimension of the composite beam was 10*10*200 mm while the thickness of CL was 1 mm. Polyvinyl acetate glue was used for the lamination. Three point bending test was conducted for these samples. The crosshead speed was 2 mm/min, and the effective span was 140 mm. Cyclic bending test was also conducted to determine the elastic deflection.

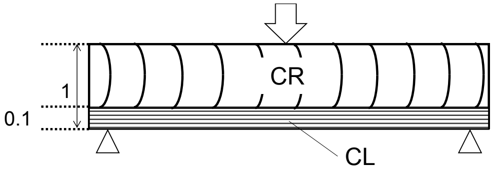


Fig.1: Structure of composite beam

RESULTS AND DISCUSSION:

In Fig.2, the compressive Young's modulus and the elastic strain of cedar wood are plotted against the initial compressive strain. As the compressive strain increased, the compressive Young's modulus decreased and the elastic strain increased. This fact suggests that the compressed wood is softer and more elastic than uncompressed wood under radial compression.

The load-deflection curves of CR and CR+CL are compared to that of uncompressed lumber in the fiber direction (U) in Fig.3. Although the uncompressed lumber was broken at 5 mm of deflection, CR did not show visible failure until 50 mm. This result indicates that the CR is much softer and ductile than the uncompressed lumber. CR+CL was stiffer than CR, but it was still ductile: it was not completely broken until 50 mm whereas surface crack was observed at around 35 mm of deflection.

Figure 4 shows the elastic deflection and the elastic bending work of 4 materials tested. The elastic deflection of CL was almost the same as that of uncompressed lumber, but the elastic bending work of CL was twice greater because of enhanced flexural rigidity. The elastic deflection of CR was 6 times greater than that of uncompressed lumber, but its elastic bending work was much smaller than that of uncompressed lumber. The elastic deflection of CR+CL was 7 times greater than that of uncompressed lumber, and its elastic bending work exceeded that of CL. That is, CR+CL composite beam is not only soft but elastic and tough under bending. In the CR+CL, CR is compressed elastically to allow large elastic deflection of the beam, while CL supports large tensile stress to achieve large elastic bending work.

The excellent toughness of CR+CL was also recognized in impact bending strength. Figure 5 shows the results of Charpy test. The Charpy value i.e. impact bending strength of CR+CL was greater than that of uncompressed lumber and comparable to that of CL.

Figure 6 exhibits the flexible deformation of CR+CL in three point bending test.

Although wood has so far been used for rigid structure, CR+CL can be used for soft-touch furniture and damping member of wooden construction. Further investigation is needed to clarify the dimensional stability and durability against repeated loading.

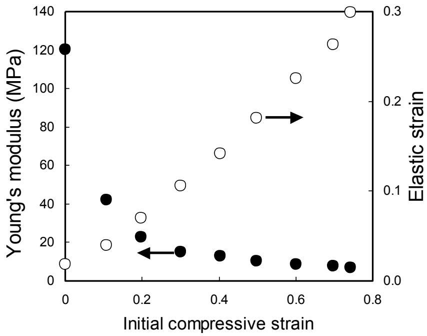


Fig.2. Compressive Young's modulus and elastic strain of compressed cedar wood as a function of initial compressive strain.

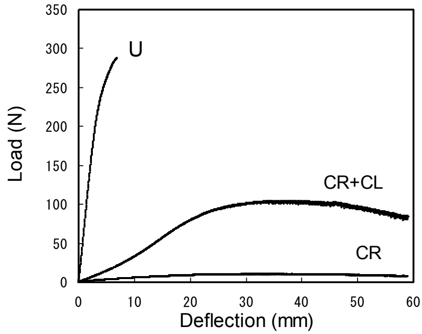


Fig.3. Load-deflection curves for uncompressed lumber (U), compressed laminated beam (CR), and composite beam (CR+CL).

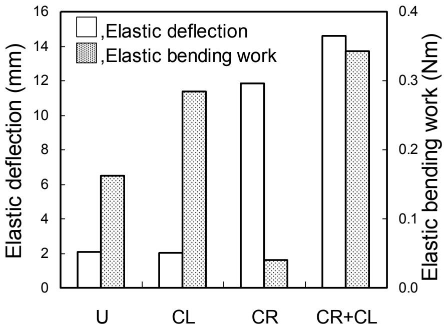


Fig.4. Elastic deflection and elastic bending work for uncompressed lumber (U), compressed lumber (CL), compressed laminated beam (CR), and composite beam (CR+CL).

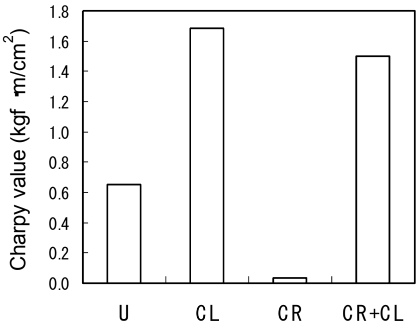


Fig.5. Charpy values for uncompressed lumber (U), compressed lumber (CL), compressed laminated beam (CR), and composite beam (CR +CL).

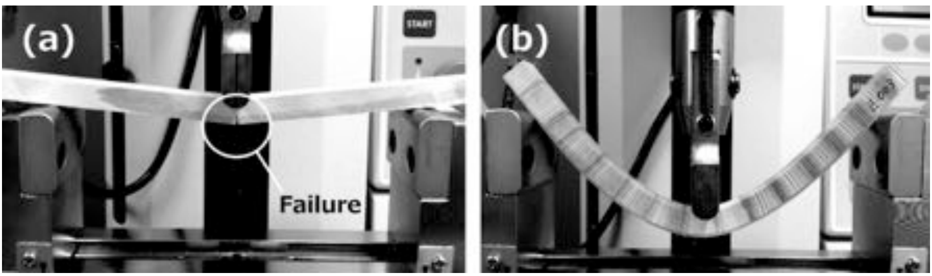


Fig.6. Failure of uncompressed lumber (a) and flexible deformation of CR+CL (b) in bending test.

WOOD AGING:

« HOW TO EVALUATE JAPANESE TRADITIONAL WISDOM IN WOOD WORKING? »

Misao Yokoyama
Division of Forest and Biomaterial Science, Kyoto University
Kitashirakawa Oiwake-cho Sakyo-ku, Kyoto, Japan 6068502
misao@kais.kyoto-u.ac.jp

Many wooden historical buildings over 1200-years-old still exist in Japan. The ancient capitals Kyoto and Nara have many traditional wooden buildings, some of which are also listed on the UNESCO World Cultural Heritage register.[1)] The most famous and the world's oldest wooden construction still standing is Horyu-ji temple from the latter half of the seventh century. And more than 90% or the nationally important properties of Japan are constructed with wood. Principally the restoration practice for historic buildings in Japan is characterized by its adherence to original techniques and materials, and also for its minimum replacement of members by new ones. As a result, it is represented by a selection of methods, which preserve the buildings for the future, without altering their structures and designs.

On the other hand, wood has also been used for various wooden artifacts like Buddhist statues, and aged ones are handled with highly care, because of their fragile qualities. It is well known that the properties of wood change over a long period in the environment after harvesting. Studies about the changes in physical and mechanical properties with elapsed time have been conducted due to the importance of safe long-term use and as basic studies of wood science. A major difficulty for such research is the gathering of suitable samples, with well-defined origin, certified dating and permission of publication by conservation administration. However, the Japanese context, where traditional uses of wood have been maintained for more than 1600 years, offers a unique opportunity to address the questions of wood aging.

The aim of this research is to understand traditional and/or folk wisdom of wood using by the way of wood/material science. Therefore, in order to understand "putting the wood species in the right places" of these houses induced by their folk customs, wood species of these timbers of traditional wooden buildings were identified and mechanical properties of them were investigated.[2, 3)] And in order to understand "aged hinoki (Chamaecyparis obtusa Endl.) wood is stronger than new ones" generally said by carpenters, the mechanical properties of naturally aged hinoki wood delivered from these Japanese historical buildings with precise dating by both radioactive carbon ^{14}C and dendrochronology methods were evaluated[3)]. In some cases, it is not allowed to get natural aged wood samples from historical buildings and cultural properties, therefore thermally treated wood were investigated as imitated aged wood for this research.

This paper deals with some results about how to evaluate traditional wisdom in wood working deeply rooted in Japanese culture in order to understand the criteria of wood selection for traditional wooden architecture and practical useful for conservation of cultural properties. Rapid deforestation, difficulty of finding successors of traditional artworks and globalization of culture promoted by recent social and economy situation becomes a serious problem on traditional way of life in not only Japan but also each countries. Therefore, scientific description of regional variation in our traditional culture can be considered as dissemination of culture and conservation of cultural properties for interchange of cultures in the future.

REFERENCES:

1. Misao Yokoyama, Joseph Gril, Miyuki Matsuo, Hiroyuki Yano, Junji Sugiyama, Bruno Clair, Sigeru Kubodera, Takumi Mitsutani, Minoru Sakamoto, Hiromasa Ozaki, Mineo Imamura, Shuichi Kawai, Mechanical characteristics of aged Hinoki wood from Japanese historical buildings, Computes Rendus Physique, 10(7) , p601-61 (2009)
2. Misao YOKOYAMA, Tahana Ramananantoandro, Yumiko Murakami, Taku Iida, Wood Identification of Zafimaniry traditional house timbers in Madagascar – Traditional wisdom of wood using, Colloque international "La biodiversite et les populations dans le context du changement climatique_Madagascar, pp24, 2013 December 10-12, Madagascar

3. Misao YOKOYAMA and Takao Itoh, Wood Identification of Japanese historical buildings: A case study of Kasa-tei and Shigure-tei of the Kodaiji temple, 8th PRWAC & IAWS2013,pp198, 2013 October 17-21,Nanjing China
4. Misao YOKOYAMA et.al, Mechanical characteristics of aged Hinoki (Chamaecyparis obtusa Endl.) wood from Japanese historical buildings –Comparison between naturally aged wood and thermally treated wood, Thermo-Hydro Mechanical Wood Behavior and Processing , pp113-114, COST Action FP0904 workshop, 2011 February 16-18, Biel, Swiss

Wednesday 10 (09:00 - 09:40) ***David Van Edwards***

« THE WOODEN ECONOMY - LOGISTICS SOLUTIONS FOR LUTEMAKERS »

David Van Edwards
Luthier and Independent Researcher/Lecturer
The Smokehouse, 6 Whitwell Road, Norwich, Norfolk, NR1 4HB, England
http://www.vanedwards.co.uk/
david@vanedwards.co.uk

The location of the first recorded major centre of lutemaking in the Füssen area of Bavaria depended crucially on the local supplies of suitables woods - spruce, maple, prunus and yew. When, because of the attractions of wealth and the dangers of war, the most important makers re-located to North Italy they faced both the difficulty of maintaining a steady supply of these woods and the opportunity of access to exotic woods from South America, India and Africa provided by the great trading ports of Venice and Genoa. Unlike makers of most other instruments they took these opportunities enthusiastically and their lutes exhibited the widest range of timbers of any instrument type. This paper tries to suggest why this was and, using surviving inventories and surviving instruments, to show how these difficulties and opportunities were faced and something of the huge scale of this timber trade for lutemakers.

Wednesday 10 (10:20 - 10:35) ***Nelly Poidevin***

« WOOD DIVERSITY IN BOW MAKING »

Nelly Piodevin
Bowmaker, 18 rue François Luzel F-22100 Dinan, France
nelly.poidevin@wanadoo.fr

The qualities of the bows are mainly dependent on the choice of the wood. It implies the shape and dimensions of the stick and thus determines its performance properties, not only its responsiveness but also the specific tone it develops on the instrument.

Over the centuries, the evolution of European bows, in conjunction with the musical tastes, has resulted in successive changes in the choice of woods and forms. The adoption of the modern model of bow and pernambuco wood at the beginning of the nineteenth century marks the end of these developments. But the range of woods used in the past is scarcely known.

Information on different species that may have been used in bow making is very fragmented. It comes from different historical sources. The testimony of surviving bows seems to be the most reliable reference. But, it is not always possible to identify the wood. On the other hand, very few pieces from earlier times than the eighteenth century are still preserved. To fill this gap, it is worthwhile to resort to written evidence, such as previous musical treaties, encyclopedias, instrumental methods and various archive documents (craft guilds charters, invoices, after-death inventories). But recognizing a wood under its former name can be problematic. Iconographical sources, which provide with trustworthy indications on structural transformation of the bows, are not very useful in the case of wood; yet some information can be gleaned concerning the color and thickness of the sticks, which suggests a range of density of the material and possibly its belonging to exotic or European wood family. It is also necessary to investigate the evolution of

wood availability, its supplying and trading routes.Finally, it may be helpful to focus on the species used for activities related to bow making.

This inquiry into historical sources points out the prevalence of specific properties of woods at each period. It can be related to the different models of bows that accompanied changes in playing habits. This highlights the interaction of wood selection, making options and musical expression.

As a constant adaptation of bow shape and material for musical purpose is attested throughout history, we may wonder why this evolution has suddenly ceased at the beginning of the nineteenth century. Probably the Tourte model perfectly fits the mechanical and acoustical properties of Pernambuco wood, or vice versa. However, musical aesthetics have changed but this type of bow is still a standard all over the world, for any style of music.

If bow geometry and physical characteristics of material are intrinsically linked, we can assume that structural modifications will occur when the change of wood will be required by the increasing difficulties in pernambuco wood supplying that are induced by its listing in the Appendix II of the CITES. To anticipate these changes, tests are performed with alternative species. Experimental bows are made with woods selected by Iris Brémaud for their specific mechanical and chemical features. This experience shows that the variations of density and dynamic qualities between species may be offset by geometric modifications. But the main effect of wood substitution concerns the sound qualities, as each wood has its proper tonal identity.

This approach, both historical and experimental, can be presented during a regular talk.

Different woods, replicas of historical bows and experimental ones can be displayed in an exhibition related to a demonstration of the "PAFI system", dedicated software carried out by the LAUM, in Le Mans – France. This program characterizes bows by calculating their rigidity, the elasticity modulus of their wood, their camber, their hair tension. It allows collecting and comparing those measures as well as it simulates geometry changes implied by wood substitution.

Wednesday 10 (10:35 - 10:50) ***Aida Se Golpaygani & al.***

« TRADITIONAL GRADING AND TREATMENT FOR JUGLANS REGIA AND MORUS ALBA USED IN IRANIAN MUSICAL INSTRUMENTS »

Aida Se Golpayegani, Seyyede Zahra Sharifi Sosari and Kambiz Pourtahmasi

Wood science and technology department, Natural resources faculty, University of Tehran, TEHRAN, IRAN

aida.golpayegani@gmail.com, , sz.sharifi@ut.ac.ir, pourtahmasi@ut.ac.ir

Wood used in making musical instruments is subjected to prejudgments and myths. Professional artisans each have their own special way to choose, prepare and treat the raw material to achieve the perfect instrument. These methods are rarely assessed by scientists and their true effectiveness is practically unknown. In this study, two wood species, Juglans regia (Walnut) and Morus alba L.(White mulberry) used for three traditional musical instruments in Iran (Santoor, Tar and Setar), are assessed for their basic acoustical properties (tanδ or damping coefficient and E'/ρ or specific modulus). Different walnut samples from various origins were graded by artisans based on visual qualifications and their experience, then tested in laboratory by non-contact forced-released bending vibrations of free-free bars. The final results were corresponded with artisanal grading, where the lines between best and worst species were clear. The middle range grades borderlines were vaguer, indicating the importance of cut, wood color and design in artisanal decision making in choosing raw material. White mulberry used in the case of lutes in Iran had a lower E'/ρ and a slightly higher than average tanδ. A cyclic drying/adsorption treatment, done partly as a recreation of natural aging of wood had successfully decreased damping coefficient without endangering the specific modulus. For both species, scientific data confirmed the traditional handling of wood -in form of grading and treatment- as efficient. However the mutual relation of treatment and instrument final form, cut and design is yet to be determined.

« OBSERVING STIFFNESS VARIABILITY IN REED CANE (ARUNDO DONAX) AND THE RESULTING VIBRATIONAL RESPONSE USING FINITE ELEMENT MODELLING »

C. Kemp and G. Scavone
Department of Music Research, McGill University
555 Rue Sherbrooke Ouest, Montreal, Quebec, Canada
connor.kemp@mail.mcgill.ca, gary@music.mcgill.ca

Much of the previous research on wind instrument sound production has focused on mouthpiece and body design, while relatively few studies have considered the reed specifically. As is known, the reed is the sound source and its behaviour drastically effects the resulting sound generated by the instrument. This reed behaviour in response to vibratory excitation can vary significantly among sets of natural cane reeds (known more accurately as the giant cane Arundo donax) despite efforts of the manufacturer to categorize the reeds according to stiffness [1]. Musicians are also sensitive to this variability and often have to sift through an entire box of reeds to find one or two that play well. Thus, it is desirable to examine the contributing microstructural factors for Arundo donax stiffness variability.

In the present study finite element models are used to compare the effects of microstructural features on the vibrational response (contributing to the acoustic performance) of alto saxophone reeds. Models are constructed using internal geometry data obtained through optical microscopy investigation of typical reed samples. The importance of modelling individual microstructural features versus homogenising stiffness properties for the finite element simulation are also compared. The importance of microstructure on directionally dependent stiffness properties for reeds can be better defined in this way, similar to the analysis of wood.

The microstructure of Arundo donax can be analyzed by considering the more broad family of natural wood structures. In general terms, wood possesses a cellular microstructure consisting of regions of solid material and a regular array of void inclusions. While the evolutionary goals of this structure extend beyond the purely mechanical domain, the resulting stiffness and strength of the wood depends on the orientation, shape, size and distribution of these void sections. This fact is easily observed in nature as trees are stiff and strong in the vertical direction (axial) while bending significantly in response to wind loads in the horizontal direction (tangential and radial). These observations are easily predicted by examining the cross-sections of wood samples in each of these orthogonal directions. A typical wood microstructure consisting of voids,

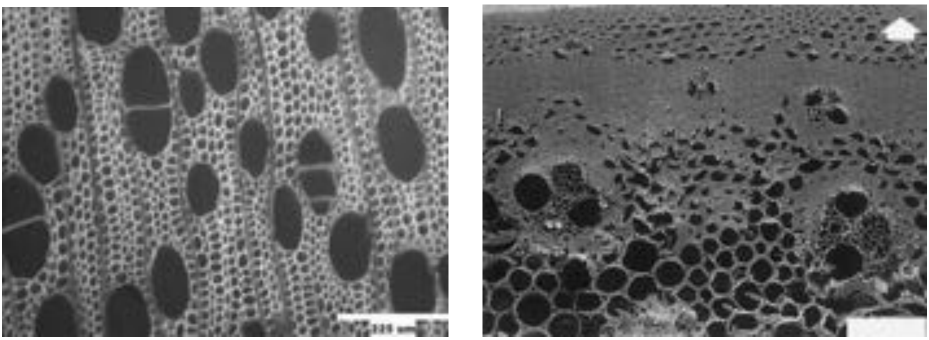


Figure 1: SEM micrographs of a poplar sample (left) (from [2]) and an Arundo donax reed sample (right). The scale of both images is shown and is on the order of 200 microns (from [3]).

knots and solid sections is provided in Figure 1 [2]. This figure also provides a micrograph (obtained via scanning electron microscopy) of an Arundo donax reed sample through the cross-section (along the long axis of the reed) for comparison [3]. Although some differences are apparent, the overall form of the structure including solid sections and voids is the same.

Given the heterogeneous microstructure found in Arundo donax, efforts to model the response of a traditional cane reed require the consideration of microstructural features that contribute to internal strain distributions [4] which arise during loading (for the case of the musician, during playing). These strain distributions yield valuable insight as to the vibrational response of the reed. Furthermore, the contributions of various microstructural features to the internal stress state of the reed are considering in the finite element model developed in the present study.

REFERENCES:

[1] J. Petiot, P. Kersaudy, G. Scavone, S. McAdams, and B. Gazengel (2013), Modeling of the subjective quality of saxophone reeds, Proc. Meet. Acoust., vol. 19, no. 1, p. 035028.

[2] A. Kutnar, F. A. Kamke, and M. Sernek (2009), Density profile and morphology of viscoelastic thermal compressed wood, Wood Sci. Technol., vol. 43, no. 1–2, pp. 57–68.

[3] S. Glave, J. Pallon, C. Bornman, L. O. Björn, R. Wallén, J. Råstam, P. Kristiansson, M. Elfman, and K. Malmqvist (1999), Quality indicators for woodwind reed material, Nucl. Instrum. Methods Phys. Res. Sect. B Beam Interact. Mater. At., vol. 150, no. 1–4, pp. 673–678.

[4] M. Kobayashi, H. Toda, Y. Kawai, T. Ohgaki, K. Uesugi, D. S. Wilkinson, T. Kobayashi, Y. Aoki, and M. Nakazawa (2008), High-density three-dimensional mapping of internal strain by tracking microstructural features, Acta Mater., vol. 56, no. 10, pp. 2167–2181.

Wednesday 10 (10:54 - 10:58) ***Capucine Carlier & al.***

« CHARACTERISTICS OF "RESONANCE WOOD" AS VIEWED BY VIOLIN MAKERS OR BY WOOD SCIENTISTS »

Capucine Carlier

Wednesday 10 (11:02 - 11:06) *Ferina Saati Khoscroshahi & al.*

« MODAL ANALYSIS OF THE TAR RESONANCE BOX USING FINITE ELEMENT METHOD »

F. Saati Khosroshahi (1) and H. Eghbal-zade (2)
(1): Department of Mechanical Engineering, Özyegin University, Istanbul, Turkey
(2): IEEE, Member, Istanbul, Turkey
ferina.saati@ozu.edu.tr

The Tar is a Persian instrument which is long-necked and waisted and the names of the Persian setae and also guitar are claimed to be derived from it. Resonance box of tar is usually made of white mulberry wood with a membrane closing it. The instrument includes no sound holes and is therefore novel in terms of acoustical analysis. In this paper, finite element models were created and natural frequencies were discussed. Mechanical properties of the wood types were also discussed and used in models.

The subject is to study the shape of Tar which is unrivaled among the other studied instruments due to the specific resonance box that is well-known in middle-east musical culture. In our case of study, the geometry is far unreachable than a hundred hours of working by hand can reach, because Iranian instruments, specially Tar, cling to no specific pattern except to some diameters and some general shapes; therefore, 3D laser scanning method is the best way to choose for describing the outside geometry of the box of Tar so that no single detail would be missed. Preliminary experimental results are derived and a spectral analysis is also done to be compared with its modal analysis. Characteristics of the instrument is looked upon from a signal processing view as well. This study lights the route for Iranian musicians and instrument makers to get to know their music better and optimize the instruments for better sounding.
KEYWORDS: string instrument, modal analysis, finite element, white mulberry, resonance box, membrane, natural frequency

Wednesday 10 (12:05 - 12:20) *David Hunt*

« SLOW CHANGES IN WOOD PROPERTIES WITH TIME, STRESS AND ENVIRONMENTS »

D. Hunt
Engineering Department, University of Reading
Whiteknights, Reading, UK
nadiroba@aol.com

It has been established that each combination of any two of the variables time, stress and environmental changes (humidity and temperature) causes changes of the dimensions of a piece of wood; the effects being different in the different anatomical directions of the wood. The analysis of the problem is complex, but a simplification can be summarised as: dimensional changes resulting from combinations of stress and time in a stable environment are known as viscoelastic creep; and those resulting from combinations of stress and environmental change are known as mechanosorptive creep. Those resulting from combinations of environmental changes and time without an applied stress can be sub-divided into the reversible dimensional changes, namely normal swelling and shrinkage; and a permanent irreversible shrinkage known as aging. These four phenomena have been studied, and some numerical data are available. However, because of the complications of the subject, and the differences of properties in the anatomical directions of the wood, there are still gaps in our knowledge.

« INFLUENCE OF WOOD POROSITY ON WIND INSTRUMENTS »

S. Le Conte, J. & P. Dalmont
Equipe Conservation Recherche du Musée de la musique. Cité de la musique.
LAUM UMR CNRS, Université du Maine, France
sleconte@cite-musique.fr, jean-pierre.dalmont@univ-lemans.fr

Are we able to demonstrate a significant influence of the material choice in the woodwind making process? Do the choices made by the makers come only from phenomenological question? In other words, are the materials selected for their acoustical signature or is the acoustical signature the result of the used material?

Oboes are traditionally made with Ebony but instruments made with Brazilian rosewood, Cocobolo or with Prunus according their geographical origin can be found. The serpent is made with maple or walnut, etc.

All these species have different properties such as color, density, Young modulus [1], and also porosity for example. Recently, [2] has demonstrated that dynamic properties of the wood species has a second level effect on the acoustical properties of the sound tube.

However, about the porosity, we can find historical testimonies such that of Jean-Benjamin de Laborde who wrote in 1780 about the bassoon: ***« Quant à la qualité du bois, il est sûr qu'un bois dur, tel que le buis, l'ébene, le bois de palissandre, etc. produira un son aigre et dur. Un autre bois trop tendre produira un son sourd, et rendra l'instrument dur à jouer, par la raison que les pores du bois étant plus ouverts, le vent ne passera pas avec facilité dans l'instrument, comme aussi il passerait trop vîte dans un autre qui serait fait d'un bois dur et sec ; il faut donc choisir un milieu entre ces deux extrémités ; c'est-à-dire, un bois qui ne soit ni trop dur, ni trop tendre : l'érable est le seul, lorsqu'il est bien choisi, qui rassemble les qualités requises, et par conséquent le seul propre à faire un instrument, tel qu'il convient, pour avoir la belle qualité de son que l'on désire. ».***

So, it seems that the influence of porosity is known by makers. Now, how can we evaluate this influence. In museums,the woodwind conservation conditions recommend to not to play the instruments to avoid high hygrometric variations inside the tube. It is then necessary to find other ways to obtain acoustical information on the historical instruments to characterize them. For that the Capteur Z input impedance measurement set up [3] is used to obtain information about the musical instrument functionality. The input impedance, which characterizes the acoustic response of an instrument at different frequencies depends only on the geometry of the bore and the internal surface and volumic properties of the tube. It can be used to evaluate the reproducibility of the wind instrument making process. It can also be used to characterize the influence of a manufacturing stage, the bending for example. This paper will present an experimental approach to the porosity effect on the input impedance. Several tubes have been made using different wood species used usually for woodwind. The input impedance of these tubes is measured and evaluated according to the porosity properties of the wood.

REFERENCES:

1. I. Brémaud, Y. El Kaïm, D. Guibal, K. Minato, B. Thibaut, and J. Gril (2012), Characterisation and categorization of the diversity in vibrational properties between 98 wood types (Annals of Forest Science, 69:3:373-386)
2. J.-B. de Laborde. Paris, 1780. Le basson : méthodes et traités, dictionnaires : anonyme, Béthisy, de Brossard, Cugnier, encyclopédie, encyclopédie méthodique, Louis-Joseph Francoe. - Courlay : J.M Fuzeau, 1999. - 136 p. : Ill. en noir,Partitions,Fac-simil. ; 33 cm. - (Fac-similé Jean-Marc Fuzeau. Méthodes & traités 4. Série 1 France 1600-1800), p.52.
3. Ch. A. Macaluso et J.-P. Dalmont "Trumpet with near-perfect harmonicity: Design and acoustic results", J. Acoust. Soc. Am. 129 (1), 404-414 (2011).

« THE WOOD OF THE ELECTRIC GUITAR: A MECHANICAL AND PERCEPTUAL DESCRIPTION »

A. Paté, J.-L. Le Carrou and B. Fabre
Sorbonne Universités, UPMC Univ. Paris 06, UMR 7190, Institut Jean Le Rond d'Alembert
CNRS, UMR 7190, Institut Jean Le Rond d'Alembert
11, rue de Lourmel, 75015 Paris, France
pate@lam.jussieu.fr

The electro-acoustic circuit carrying and transforming the sound of a solid body electric guitar is quite complex: in the most common way electro-magnetic pickups transduce the strings velocity into an electric signal which is sent to some effect processing devices, then to an amplifier supplying the final signal to be radiated by the loudspeaker [1]. Although the chain going from the pickup to the loudspeaker is of critical importance, the sound still originates from the mechanical vibration of the strings. Despite its name, the solid body electric guitar vibrates and couples with the strings: the string vibration, hence the sound, can be explained by vibratory investigations of the structure of the instrument [2,3]. Mechanical studies have led to a string/structure coupling model describing the string vibration as a function of the measured vibratory response of the structure [4]. Coincidence between the string playing frequencies and the structural resonance frequencies may occur: this results in decay time changes, or in timbre modifications.

Among the factors modifying the vibratory behaviour of the electric guitar structure are the lutherie parameters. As a matter of fact, many lutherie decisions can lead to produce very different instruments: wood species selection for the body, the top, the neck, or the fingerboard, shape design of any of these parts, junction type between parts (glue, screws, etc.), wood cuts, varnish, etc. Interesting is to pay attention to the common knowledge and experience of the electric guitar players and makers: each of these lutherie parameters is known to alter the sound. The aim of the presented work is to characterise both mechanically and perceptually the influence of the lutherie parameters on the sound.

We take the example of the fingerboard wood. Six guitars were hand-produced especially for our studies: they follow the specifications of the Les Paul Junior by manufacturer Gibson. They are nominally identical, except in the only intentional difference: the wood of the fingerboard. Three guitars have a rosewood fingerboard, and three have an ebony fingerboard (see figure 1).

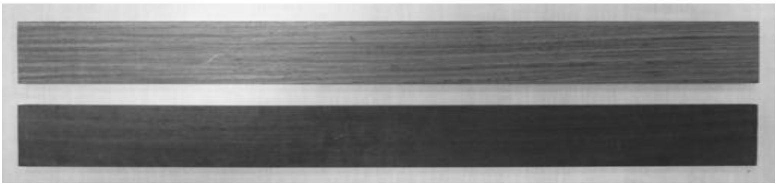


Figure 1: the two wood species used in the mechanical and perceptual studies of the fingerboard wood: rosewood (top) and ebony (bottom).

Vibratory testing has been able to design a descriptor making the discrimination between ebony and rosewood fingerboards possible with mechanical means [5]. This descriptor is the mean conductance computed over the low- and mid-frequency range. Its values are related to the amount of energy which is transfered from the string to the structure, hence of the extent of decay time alteration for the concerned string partials. The rosewood fingerboard is expected to couple stronger with the strings, and then to modify the sound in a deeper way than the ebony fingerboard does. In particular, more unevenness (hence more "richness"?) in the sound spectrum of notes from rosewood-fingerboard guitars is expected.

On the other hand, this lutherie parameter can be perceptually described [6]. Professional guitarists have been invited to undertake a free playing and verbalising task with the guitars. Applying psycho-linguistical methods on the raw verbal productions recorded during the blind playing test allows to extract psychologically relevant descriptors for the characterisation of the fingerboard wood. Some of these descriptors are related to the concepts of “precision”, “clarity”, and “balance”, opening the way to establishing the link with the mechanical description.

A mechanical description of the string/structure coupling and of the lutherie parameters has been developed: different lutherie decisions (and in particular the wood selection) alter the vibratory behaviour of the structure differently. The effect is a change in the boundary conditions of the strings, hence a change in the sound. The sound alteration due to a lutherie parameter has been perceptually characterised in the case of the wood of the fingerboard.

All these results are obtained on handcrafted guitars. Therefore they are to be put into perspective in order to take into account for the historical, organological, and economical background of the solid body electric guitar. Indeed the electric guitar stands out from other musical instruments, since it is the only instrument to have been originally designed to be mass-produced [1]. An industrial strategy aims at producing identical instruments (see figure 2), conforming to precise lutherie decisions. The question of the reproducibility of mechanical features in the industrial electric guitar making is crucial. What is the variability among nominally identical industrial guitars due to the making process? How well do mechanical differences due to lutherie changes withstand the differences due to the manufacturing process? A series of measurements has been carried out on large sets of industrially-made electric guitars at the end of the production chain. Variabilities due to the making process and due to the lutherie changes are compared [7].

Figure 2: nominally identical guitars at the end of a mass-production unit.

REFERENCES:

1. A. Paté, B. Navarret, R. Dumoulin, J.-L. Le Carrou, B. Fabre, and V. Doutaut (2012), About the electric guitar: a cross-disciplinary context for an acoustical study (Proceedings of the Acoustics 2012 conference, Nantes, France)
2. H. Fleischer and T. Zwicker (1999), Investigating dead-spots of electric guitars (Acta Acust. united with Acust., 85:128-135)
3. H. Fleischer and T. Zwicker (1998), Mechanical vibrations of electric guitars (Acta Acust. united with Acust., 84:758-765)
4. A. Paté, J.-L. Le Carrou, and B. Fabre (2014), Predicting the decay time of solid body electric guitar tones (J. Acoust. Soc. Am, 135:5:3045-3055)
5. A. Paté, J.-L. Le Carrou, and B. Fabre (2013), Ebony vs. rosewood: experimental investigation about the influence of the fingerboard on the sound of a solid body electric guitar (Proceedings of the Stockholm Musical Acoustics Conference, 182-187)
6. A. Paté, J.-L. Le Carrou, B. Navarret, D. Dubois, and B. Fabre (2014), Influence of the electric guitar's fingerboard wood on guitarists' perception (submitted to Acta Acust. united with Acust.)
7. A. Paté, J.-L. Le Carrou, and B. Fabre (2014), Modal parameter variability in industrial electric guitar manufacturing (to appear in the proceedings of the ISMA/USD conference, Leuven, Belgium)

« ASSESSMENT OF MOISTURE-DEPENDENT VIBRATIONAL PROPERTIES OF ROSEWOOD »

Aleš Straže, Bogdan Mitkovski, Željko Gorišek
University of Ljubljana, Biotechnical Faculty, Rožna dolina, C. VIII/34, SI-1000 Ljubljana, Slovenia;
ales.straze@bf.uni-lj.si

INTRODUCTION:

Wood is widely used for percussion instruments, especially for tuned idiophones, such as xylophones and marimbas, with which sound is produced by striking wooden bars with a mallet. The dynamic mechanical, or vibrational properties, including mechanical damping of wood importantly affect the sound quality of such instruments.

In general most wood mechanical properties vary inversely with moisture content of wood (MC) bellow fibre saturation point (FSP) [Unterwieiser and Schickhofer, 2011; Ozyhar et al., 2013]. Additionally, the wood MC seems to work as plasticizer with adsorbed water molecules in the material. Therefore several authors report on reduced sound damping in many softwoods equilibrated at low relative humidity [Matsunaga et al., 2000; Obataya et al., 2001; Jiang et al., 2012], where also relative maximum at specific wood MC was reported [Obataya et al., 1998]. Moisture content of wood significantly affects also its shrinkage / swelling and the wood density which coupled with dynamic storage- and loss modulus impact its acoustic properties.

In the present study we will try to estimate the influence of moisture content on some acoustic properties of rosewood, an important wood species for tuned idiophones manufacturing.

MATERIAL AND METHODS:

In the timber yard of a commercial tonewood provider, we inspected large timber stack of Honduras rosewood (Dalbergia tucurensis) and collected 56 raw xylophone bars of 28 mm thickness. Bars had width from 62 to 87 mm and the length varied from 410 to 560 mm, which appeared to have suitable properties for the production of xylophone bars. The selection was based on visual inspection of the boards. The selected boards were air-dried and had no visible wood defects, were flat sawn, had straight grain, and were top graded by the timber provider.

The bars were exposed to impact forced free-free flexural vibrations, using a steel ball. Displacement was measured at the belly of the vibration by a condense microphone (PCB–130D20), whereby the signal was acquired by NI-9234 data acquisition module. Signal and frequency scans were made on a recorded and pre-triggered 3 s long signal at 24-bit resolution at a 51.2 kS/s sample rate in LabView 8.0 ® software. An time-decayed vibration curve of the fundamental frequency f_1 was fitted, using least-squares regression, whereby the value of the damping coefficient (tanδ) was determined. The fundamental frequency and the wood density were furthermore used, according to the Euler-Bernoulli equation, to determine dynamic specific modulus of elasticity (E'/ρ). Acoustic properties of bars were additionally determined by acoustic coefficient (K), acoustic conversion efficiency (ACE) [Roohnia et al., 2011] and relative acoustic conversion efficiency (RACE) [Obataya et al., 2000].

Normal temperature convectional drying followed afterwards in a laboratory kiln drier, using standard drying schedule, at 30 °C average temperature. The final 5-days long conditioning drying phase had 24 °C and 50% relative humidity (RH). The measurements of the vibrational properties of bars were repeated afterwards, using the same experimental setup. The resonant frequencies of the bars at initial and final stage ranged from 350 to 850 Hz.

RESULTS AND DISCUSSION:

The average initial air-dry density of tested rosewood amounted 1080 kg/m^3 (CV% = 5.1), where dynamic modulus of elasticity (MOE) reached 22.2 GPa (CV% = 10.9). The mean relatively high initial damping coefficient (tanδ = 0.011, CV% = 12.4) can be partly ascribed to the high initial moisture content of wood (MC_i = 7.2…12.2…18 %, CV% = 20.3). The initial average acoustic properties of rosewood calculated there from amounted: K = 4.02 m^4.s^{-1}.kg^{-1}, ACE = 403.3 m^4.s^{-1}.kg^{-1}; RACE = 433.9 km.s^{-1}.

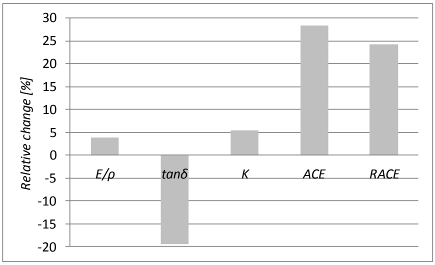


Figure 1: Change of acoustic properties of rosewood after drying.

The wood drying significantly decreased wood moisture content (MC_i = 4.5…8.6…11.0 %, as well as its variability (CV% = 14.5). Slight decrease of wood density after drying was confirmed (-3.2%), and increase of MOE to 22.4 GPa. Highly significant were improvements of (E'/ρ) (+3.9%) and especially of tanδ (-19.5%). Consequently significantly improved other acoustic properties of rosewood were determined (K (+5.4%), ACE (+28.3%), RACE (+24.3%)) (Fig. 1).

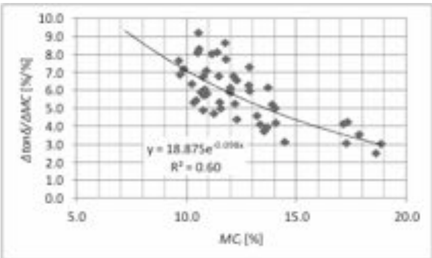


Figure 2 Impact of moisture content on the change of damping coefficient of rosewood.

The inverse proportionality of specific modulus of elasticity with moisture content of wood was confirmed at the test MC-interval, having average change of 1.03%. The reduction of damping coefficient was contrary significantly affected by MC of wood, where higher changes were present at lower wood moisture content (Fig. 2).

The results confirmed the importance of proper, low enough, moisture content of wood, which improves its acoustic properties and subsequent input quality of raw wood material for manufacturing of tuned idiophones.

REFERENCES:

Jiang J., Jianxiong L., Cai Z., BioResources, 7:3585-3596, 2012.

Matsunaga M., Obataya E., Minato K., Fumiaki N., Journal of Wood Science, 46:122-129, 2000.

Obataya E., Minato K., Tomita B., Journal of Wood Science, 47:317-321, 2001.

Obataya E., Norimoto M., Gril J., Polymer, 39:3059-3064, 1998.

Obataya E., Ono T., Norimoto M., Journal of Materials Science, 35:2993-3001, 2000.

Ozyhar T., Hering S., Sanabria S.J., Niemz P., Wood Science and Technology, 47:329-341, 2013.

Roohnia M., Tajdini A., Manouchehri N., NDT&E International, 44:13-20, 2011.

Unterwieiser H., Schickhofer G., European Journal of Wood and Wood Products, 69:171-181, 2011.

« TECHNOLOGICAL ANALYSIS OF EARLY WOODEN MUSICAL INSTRUMENTS: A CONTRIBUTE TO THE DEFINITION OF TRADITIONAL KNOWLEDGE SYSTEMS »

Marco Fioravanti
GESAAF, University of Florence, Via San Bonaventura 13, Florence, Italy
marco.fioravanti@unifi.it

HUMAN PRODUCTIONS AS POTENTIAL RESERVOIR OF KNOWLEDGE:

Any human production, that has enabled to interpret and transform reality, represents indeed a potential reservoir of knowledge to be exploited in the present.

For humankind the change produces effects both internally, in the way of being, thinking and express our humanity, and externally when we transform and use the environment in which we live.

Human and environmental changes are structurally intertwined. This interactive process of human settlement vary over time, allowing the unfolding of various forms of human populations, which live their lives and perpetuate it, generation after generation, in order to realize and fulfill their individual and collective destiny.

The change affects both the tangible dimensions of personal development (body and bodies) and the development of territories (technological material production of culture and society) and both intangible dimension of personal development (individual and collective psyche) and development of territories (ideological immaterial production of culture and society). The know-how of the context leads to a synthesis of individual and collective knowledge in the same territory. The knowledge is constructed through the material and intangible production sorted out and selected during the time in same social and cultural reality. This know-how (signifiers) is called to encode, legitimize, store and transmit sensations, emotions, ideas, feelings shared (meanings). In this process, as well as signs / meanings constructed by human communities, enters also the signs of the natural environment (elements, flora and fauna), carrying their implicit meaning.

This view bring to consider Local and indigenous knowledge as a body of knowledge, skills, practices, feeling, emotions and representations that have been maintained by local communities through complex interaction with the natural environment, highlighting the close relationship that has existed over the centuries between human communities, technology and natural environment. (This knowledge can be defined by different disciplines by means of specific terms like traditional ecological knowledge's (TEK), ethnobotany/biology, vernacular architecture, material knowledge, etc.) They therefore represent one of the highest expressions of the human presence in a geographical contest along a significant time domain, and an important resource challenging Heritage preservation and sustainable development. This achievement might be pursued through an holistic approach to local and indigenous knowledge in the field of natural ecosystems and human architecture and cultures.

TK AND MUSICAL INSTRUMENTS:

Wood, wooden objects and products, have accompanied the development of Human civilization, representing today a very large source of information for studies on traditional knowledge as well as on tangible and intangible heritage.

On top of any Wooden objects, Musical instruments and early musical instruments in particular, represent one of the highest expression of a process of building technology exclusively based on the empirical learning in the use of materials and constructive technologies. The technological analysis of such instruments might allow the reconstruction of these systems of knowledge, giving important contributes to the studies on TK and organology. In this analysis crucial steps are represented by the identification of the wood specie, by the observation of object's structural assembling, by the assessment of working techniques and working tolls used.

From methodological point of view particular attention will be focused on the importance to establish large data base of samples belonging to different objects categories or historical contests, which statistical analysis might be used to support knowledge's acquisition evidencing, in example, the local or regional use of some specific wooden species for certain technological applications.

TK, CREATIVITY AND DEVELOPMENT:

Safeguarding skills and other types of intangible heritage represents a serious challenge for today societies, as it gives concrete meaning to human rights, and promotes development. This open to the necessity of a new model of economical development rooted in the past and open to the future. A model that considers the "Knowledge" embedded in its tangible and intangible heritage as its main symbolic capital nd competitive advantage.

The preservation of these knowledge and skill is absolutely necessary for preserving not a nostalgic and marginalized view of the past, but because they can promote creativity and development.

Creativity and development, personal and collective identities represent fundamental values also for promoting and preserving social cohesion, one of the main problems of today and of tomorrow, and in this respect Cultural Heritage can play a strategic and fundamental role.

Thursday 11 (10:00 - 10:15) ***Daniela Tesarova & al.***

« INFLUENCE OF CLASSIC FINISHED SURFACES OF MASSIVE WOOD ON INDOOR ENVIRONMENT »

Doc. Ing. Daniela Tesařová (Ph.D.), Ing. Petr Čech (Ph.D.), Ing. Josef Hlavatý
Mendel University in Brno, Faculty of Forestry and Wood Technology, Institute of furniture, design and habitation

This paper there will be discussed the influence of classic finished surfaces of samples made from wooden massive materials, such as oak, cherry and oak on indoor environment. In this contribution there is investigates the problematic of VOC emissions and the assessment of their olfactory impacts. The main goal of this contribution is determine the odors emitted by wooden massive materials, such as oak, cherry and oak finished by classic coatings materials. Volatile organic compounds emissions emitted by three kinds of classic finished surfaces by classic coating materials such as shellac varnish, wax coating materials dissolved in solvent turpentine, oil-based coating materials were measured and results of the measuring are introduced in this contribution.

We used for the measurement emissions emitted by classic finished surface special combined techniques of the sensorial analysis E-nose Sniffer in conclusion with the GC-MS chromatography and the thermal desorption.

We collected air containing VOC emissions into the desorption tube. The collected air on the sorbent TENAX TA into the desorption tube is evaluated and split of the effluent of chromatography column into two streams. One stream is analyzed by the detector of the gas chromatography and the second stream is passed into an effluent of Sniffer. The sniffing port obtains a human olfactory response. We reached by using this special technique the identification of odour components by sniffer in the same time, when we reached results of gas chromatography. The results of gas chromatography is the chromatogram with quality and quality identification of chemicals and the results coming in the same time from human olfactory response sniffer is the olfactogram. We can compare the both results the quality and quantity determinate volatile organic compounds to the sensory results, results of the chromatogram and the results of the olfatogram.

This study researches the correlation between the results, which were obtained by the olfactory assessment and the measurement results of the volatile organic compounds emitted by the chosen kinds of covering textiles. The observed odor intensity is dependent on the amount of odorants emitted volatile compounds, the exposure of quantity of TVOC to human olfactory system and the influence of the different olfactory stimuli on the human body, expressed as the intensity of sensation and hedonic tone.

The contribution is finished by comparing the quality and quantity of VOC emissions emitted by classic finished surfaces with the VOC emissions emitted by polyurethane and watter borne finished surfaces of the same kind of massive wood.

« NATURAL AND ACCELERATED AGING OF ZELKOVA (ZELKOVA SERRATA MAKINO) WOOD »

M. Matsuo[1*], M. Yoshida[1], H. Yamamoto[1], K. Umemura[2], S. Kawai[3]
[1]Graduate School of Bioagriculture, Nagoya University, Furo-cho, Chikusa-ku, Nagoya-shi, Aichi, Japan
[2]Research Institute for Sustainable Humanosphere, Kyoto University, Gokasho, Uji-shi, Kyoto, Japan
[3]Graduate School of Advanced Integrated Studies in Human Survivability, Kyoto University, 69 Yoshidakonoe-cho, Sakyo-ku, Kyoto-shi, Kyoto, Japan
*miyuki@arg.nagoya-u.ac.jp

INTRODUCTION

Service life of wood can exceed thousands of years under the conditions where biodegradation and weathering are avoided, as represented by a lot of old wooden buildings in Japan. In such conditions, aging in ambient conditions becomes a major source of deterioration of wood, which accompanies significant changes in physical, mechanical, and chemical properties. Understanding of wood aging is important not only for the preservation and restoration of wooden artifacts, but also for the purposes of basic wood research. Kohara widely investigated the natural aging of wood from historical buildings and reported important suggestions [1, 2]. However, a drawback in his studies was that the age of the wood was estimated based on the architectural history and style of the buildings.

Aging is considered as the reaction which proceeds slowly in wood under participation of the omnipresent oxygen and water at ambient temperature. Therefore, treatment at high temperature possibly accelerates the natural aging. Our previous study for hinoki wood (Japanese cypress, Chamaecyparis obtusa Endl.) showed that color change during natural aging could be accelerated by dry thermal treatment (Fig.1) [3].

This study aims to evaluate the changes in wood properties during natural aging by using wood samples from Japanese historical buildings. Furthermore, the physical and mechanical properties of the naturally aged wood were compared with those of the wood treated at high temperature.

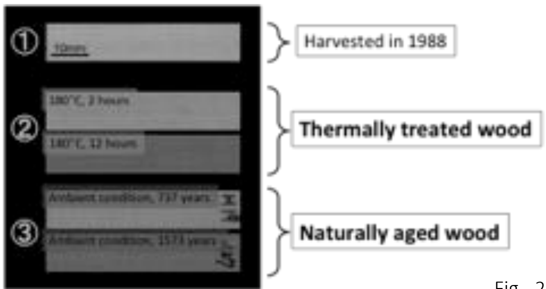


Fig. 1 Similarity in color of naturally aged hinoki wood and thermally treated hinoki wood [3].

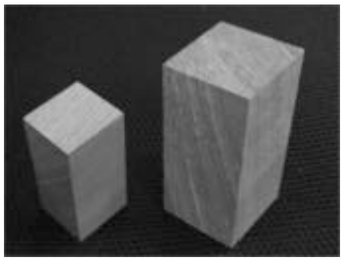


Fig. 2 Examples of keyaki wood samples from Japanese historical buildings. Left: aged for approximately 580 years. Right: aged for 230 years.

MATERIALS AND METHOD:

The wood species used was keyaki (Japanese zelkova, Zelkova serrata Makino), one of the typical hardwoods used for traditional buildings, cultural artifacts and furnitures in Japan (Fig. 2).

The aging durations of the samples, which were determined by radiocarbon dating, ranged from approximately 180 years to 580 years as of AD 2011. Recently cut and then naturally dried wood sample was also used for control and thermal treatment. Specimens were carefully cut from inner parts of the samples which were free from biodegradation, weathering, stains, and defects with the dimensions of 60mm (longitudinal) × 10mm (radial) × 2mm (tangential). Specimens from the recently cut sample were treated at 90~180°C in an oven.

Measured properties of the specimens were density, equilibrium moisture content (EMC), color, crystallinity, microfibril angle (MFA), and mechanical properties. For EMC and mechanical properties, specimens were conditioned at 20°C and 60% relative humidity. Modulus of elasticity (MOE), modulus of rupture (MOR) and rupture energy were calculated from the results of 3-point bending test.

RESULTS AND DISCUSSION:

The values of color parameters, MOR and rupture energy showed significant changes during aging. Color became darker and more red, as expressed by the results that the values of color parameters L* and b* decreased and a* increased. The aged wood became weaker and more brittle, as expressed by the results that MOR and rupture energy decreased. Significant changes were not observed in density, EMC and MOE during aging. Crystallinity and MFA also did not show clear tendency. The changes in mechanical properties of keyaki wood during aging were different from those of hinoki wood [4]. This might be because of the difference in chemical components and morphological characteristics between keyaki and hinoki wood, furthermore, might explain the scientific reasons why our predecessors have empirically chosen different wood species for each usage.

For thermally treated wood, density, EMC, MOE, MOR and rupture energy decreased. Color became darker [5], but less reddish than naturally aged wood. Namely, the changes in color, MOR and rupture energy during thermal treatment were similar with those during natural aging, while those in the other properties were not. These results implied that thermal treatment could accelerate the changes in some properties, though comprehensive accelerated aging treatment was still difficult.

REFERENCES:

1. J. Kohara (1958a), Study on the old timber (Journal of the Faculty of Engineering, Chiba University 9:1–55)
2. J. Kohara (1958b), Study on the old timber (Journal of the Faculty of Engineering, Chiba University 9:23–65)
3. M. Matsuo, M. Yokoyama, K. Umemura, J. Sugiyama, S. Kawai, J. Gril, S. Kubodera, T. Mitsutani, H. Ozaki, M. Sakamoto, M. Imamura (2011), Aging of wood: Analysis of color changes during natural aging and heat treatment (Holzforschung 65:3:361-368)
4. M. Yokoyama, J. Gril, M. Matsuo, H Yano, J. Sugiyama, B. Clair, S. Kubodera, T. Mistutani, M. Sakamoto, H. Ozaki, M. Imamura, S. Kawai (2009), Mechanical characteristics of aged hinoki wood from Japanese historical buildings (Comptes Rendus Physique 10:7:601-611)
5. M. Matsuo, K. Umemura, S. Kawai (2014), Kinetic analysis of color changes in keyaki (Zelkova serrata) and sugi (Cryptomeria japonica) wood during heat treatment (Journal of Wood Science 60:12–20)

Thursday 11 (10:30 - 10:45) ***Delphine Jullien & al.***

« HYGRO-MECHANICAL BEHAVIOUR OF WOODEN PANELS FROM CULTURAL HERITAGE: EFFECT OF A COATED FACE »

Delphine Jullien, Cécilia Gauvin, Joseph Gril
Equipe Bois, Laboratoire de Mécanique et Génie Civil
Université Montpellier 2, Place Eugène Bataillon, CC048
34095 Montpellier Cedex 5 (France)
delphine.jullien-pierre@univ-montp2.fr

Panel paintings belong to tangible heritage, and their conservation is needed to preserve artistic and historical memory. Several factors can cause damage both to the wooden support and to the paint layer. With the exception of biological decay, the principal risks originate from the microclimatic changes. As an organic material, wood responds readily to changes in ambient temperature and humidity, absorbing and desorbing moisture as environmental conditions fluctuate. The absorption and desorption of moisture results in mechanical changes such as swelling and shrinking of wood. Repeated cycles of swelling and shrinking—often occurring over centuries—will cause panels to warp, twist, or split. This type of damage to a painting's substrate can, in turn, have a dramatic effect on the paint layer, potentially resulting in paint loss.

In this presentation, the dimensional changes of a raw wooden board due to hygro-thermal variations will be explained, function of its ring orientation. Then, the behaviour of a board with a coated face will be considered. Thus, a board restrained by crossbeams or reinforcements on the back will be studied. These situations will be illustrated using finite element analyses.

KEYWORDS : wood, cultural heritage, painted panels, hygrothermal variations.

FRENCH VERSION:

Les peintures sur panneaux de bois font partie du patrimoine culturel. Leur conservation doit tenir compte de la préservation de leur mémoire artistique et historique. Plusieurs facteurs peuvent endommager le support bois et la couche picturale. Mise à part la dégradation biologique, les risques principaux sont dus aux variations microclimatiques. Matériau organique, le bois réagit rapidement aux changements d'humidité et de température ambiante, par absorption ou désorption d'humidité suivant les fluctuations des conditions environnementales. L'absorption et la désorption d'humidité entraînent des changements mécaniques tels que le gonflement ou le retrait du bois. Des cycles répétés de gonflement et retrait – durant généralement plusieurs siècles – mènent au gauchissement, à la torsion ou à la fissuration des panneaux. Le support d'une peinture ainsi endommagé peut à son tour entraîner des conséquences dramatiques sur la couche picturale, menant potentiellement à des pertes de peinture.

Dans cette présentation, nous expliquerons les changements dimensionnels d'une planche de bois brute soumise à des variations hygrothermiques, en fonction de l'orientation des cernes. Puis nous considérerons le cas d'une planche avec une face peinte. Pour finir, nous étudierons le cas d'une planche restreinte par des traverses ou des renforcements au dos. Ces situations seront illustrées par des analyses par éléments finis.

MOTS-CLÉS : bois, patrimoine culturel, panneaux peints, variations hygrothermiques

Thursday 11 (10:45 - 10:50) — ***Jean Gérard & al.***

« WOOD FINISHES USED BY TRADITIONAL SOCIETIES IN AFRICA AND OCEANIA, AND BY EUROPEAN PERIOD FURNISHINGS RESTORERS »

Jean Gérard[1] and Catherine Gérard[2]
(1): Unité de Recherche Biomasse, Bois, Energie, Bioproduits (BioWooEB)
(2): Délégation à l'Information Scientifique et Technique
CIRAD, TA B-114/16, 73 rue J.F. Breton 34398 Montpellier Cedex 5 (FRANCE)
jean.gerard@cirad.fr, catherine.gerard@cirad.fr

Wood finishes (paints, varnishes, stains and waxes) are applied mainly to modify the visual appearance of wood products depending on the desired effect, and to protect wood surfaces. Wood finishes used by traditional societies in Africa and Oceania were essentially composed of stains applied on wood products for decorative purposes, very often in connection with a precise ritual.

A main part of these stains and pigments comes from ancient uses for tissues colourations, and are sometimes used for food additives.

Vegetable pigments and minerals were the main components of wood finishes, generally diluted in the water or possibly in vegetable or animal oils. Primary colours were mixed together in order to obtain a wide range of secondary stains. Among these colouring matter of vegetable origin, the most common are obtained from berries, fruits, tree barks, mushrooms, or even insects like cochineal used for red and purple colours (mainly from South America and Mediterranean region, but also Australia and neighbouring areas).

In Africa et en Oceania, the most emblematic and frequently used stains are: (i) indigo extracted from grinded leaves, then fermented and mixed to fillers (clay, potash, slaked lime, …); indigo tree (Indigofera tinctoria) widely grown throughout all tropical regions; (ii) roots of African sorghum which are left to ferment to obtain red shades stains [1]; (iii) curcuma root which gives bright yellow or green or ochre stains when used with iron or copper salts [2]. Other plant species are used to obtain stains or paints for wood items: Alectra sessiliflora, Baphia nitida, Philenoptera cyanescens, Terminalia chebula…[3]

Black stain, commonly used for different decorative items like masks, is extracted from iron oxide or simply obtained from wood (or other plants) charcoal.

Before applying finishes, wood surfaces are sanded and polished, traditionally with the help of trees leaves containing silica, or using wet sands or earths with various particle sizes [4].

Nowadays, sandpaper is used by all the wood craftsmen, and many natural-based stains and wood finishes are no more known and employed. For convenience, they prefer ready-to-use finishes, even if some of them can have a natural origin.

Wood craftsmen and period furnishings restorers mainly use four finishes types: waxes, stains, oils and varnishes [5].

* Waxes, coloured or not, are finishes which give the lowest level of protection to wood because solvent evaporation is the only chemical action. The two most common wax bases are beeswax generally from Africa and Carnauba wax extracted from a Brazilian palm tree; some “mineral” waxes such as paraffin are sometimes used.

* Stains include dyes or pigments, natural or not, dissolved in a solvent (alcohol, organic solvent or water), and sometimes mixed with specific additive such as fillers. Natural stains mainly come from vegetable products: walnut stain, catechu, orcanette (Alcanna tinctoria), curcuma, rocou, logwood (Haematoxylum campechianum), chicory …

* Oils are more and more appreciated because easy to apply; moreover, they are not film-forming products and give a soft and silky touch to wood products. The most appreciated are drying oils which harden under the influence of oxygen (the most famous are flax oil and Tung oil).

* Varnishes are different from the 3 other categories of wood finishes because of their film-forming characteristics. They are made up of a binder (resin from natural origin or synthetic) and a solvent for “conveying” the binder and eventually adjusting viscosity. The varnish film is formed by polymerization of resins or simply by solvents evaporation, as for cellulosic varnishes and shellacs commonly used by period furnishings restorers. These two last types of wood finishes have a reduced film-forming effect; thus, wood surfaces look more smooth and natural than with synthetic varnishes.

The difference between varnish (transparent) and paint (opaque) is only due to fillers and pigments that provide opacity to the product.

Various aesthetic effects can be brought to wood finishes in order to obtain an ancient appearance: ceruse, crackled appearance, lacquering. These wood finishes require sophisticated technical knowledge. Traditional stamp varnishing (= French polish) is doubtless one of the more sophisticated varnish technic, barely used today because of its very high cost, and almost only used by period furnishings restorers.

REFERENCES:

1. Musée Dapper, C. Falgayrettes-Leveau (2000), Arts d'Afrique (Edition Gallimard), 359p.
2. Musée Barbier-Müller (1993), Arts de la Côte d'Ivoire (Collections du Musée Barbier-Mueller, éditeur Jean Paul Barbier), 2 volumes, 422p. - 229p.
3. P.C.M. Jansen and D. Cardon (Editeurs) (2005). Ressources végétales de l'Afrique tropicale 3. Colorants et tanins (Traduction de : Plant Resources of Tropical Africa 3. Dyes and tannins, Fondation PROTA, Wageningen, Pays-Bas / Backhuys Publishers, Leiden, Pays-Bas / CTA, Wageningen, Pays-Bas. 238 p.
4. T. Herbinière (2006), Polychromies sur bois : apprêts traditionnels, couleurs – finitions (Collection Les Ateliers du savoir-faire, Édisud), 107p.
5. P. Messin (2011), Bois : guide des finitions (Collection La Bibliothèque du bois, Edition l’Inédite), 122p.

« ANTHROPOMETRIC RESEARCH OF THE ADULT POPULATION AND ITS APPLICATIONS IN ARCHITECTURE, INTERIORS AND FURNITURE »

Ing. arch. Martin Kovařík (Ph.D.), Mgr. Martin Čuta (Ph.D.)
Department of Furniture, Design and Habitat, Mendel University Brno, Zemědělská 3, 61300 Brno, Czech Republic
makov58@gmail.com

This thesis focuses on research in the field of anthropometric measurements of the adult population, its history, basic concepts and research itself, conducted under the author’s leadership of the NIS project at the Mendel University in Brno.

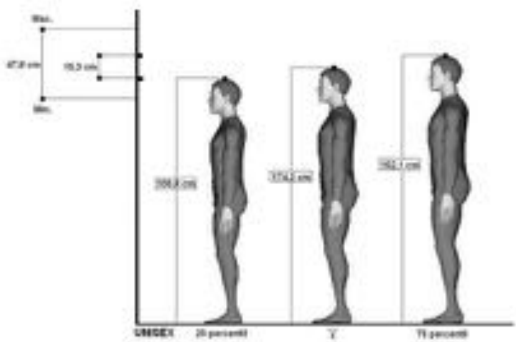


Fig. 1: Height standing person: difference between the values of the 25th, 50th and 75th percentile

The research results and its application in the field of interiors and furniture should be used to revise the architectural patterns and standards dealing with the relations on the axis between man – interior – furniture. It describes the relations of individual parameters, a person's height and weight, their development depending on age and sex, compares the height curve growth in Czech population and in Europe.

The current values used in architecture based on 70 years of research are outdated and do not meet present population. How changed the dimensions of man? What are the main dimensional differences between a man and a woman? How is necessary to change the seating furniture to fit the human body (accepting Body Conscious Design principles)?

The results of the work should serve as a basis for revising the existing typological principles and standards with regard to new results; in conclusion the author proposes conceptual changes of the fixed schemes in relations of man and furniture, interior and architecture.

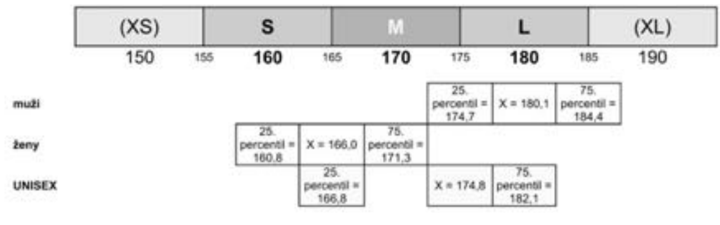


Fig. 2: Suggested dimensional range of human heights – men – women - UNISEX (in cm) for seating furniture

REFERENCES:

1. BLÁHA, P. Antropometrie československé populace od 6 do 55 let: Československá spartakiáda 1985. Praha: ÚV ČSTV, 1986.
2. DLABAL, S. Nábytek, člověk, bydlení. Praha: Ústav bytové a oděvní kultury, 1976. 178 s.
3. JIRKOVSKÝ, Daniel. Tělesná výška a hmotnost mladých mužů ve věku 18–25 let v druhé polovině 20. století. Vojenské zdravotnické listy [online]. 2003, roč. LXXII, č. 5 [cit. 2011-06-15], s. 217-220. Dostupný
4. JOSEPHY, M. Jak rostou Češi. National Geographic, leden 2006

5. MANDAL, A.C. The seated man: homo sedens. 3rd rev. ed. Klampenborg, Denmark: Dafnia Publications, 1985. ISBN 87-982-0171-9.
6. PANERO, J. -- ZELNIK, M. Human dimension & interior space: a source book of design reference standards. New York: Whitney Library of Design, 1979. 320 s. ISBN 0-85139-4574.
7. ÚVOD DO STUDIA ANTROPOLOGIE, DEFINICE OBORU A DÍLČÍCH OBORŮ [online]. . [cit. 2011-06-15]. Metody antropologického výzkumu. Dostupné
8. VIGNEROVÁ, Jana. Státní zdravotní ústav: 6. Celostátní antropologický výzkum [online]. 7. leden 2008 [cit. 2011-06-16]. Dostupné
9. VINK, Peter. Comfort and design: principles and good practice. Boca Raton: CRC Press, 2005. 293 s. ISBN 0-8493-2830-6. str. 137-145.

Thursday 11 (11:55 - 12:10) ***Sara Robinson***

« MODERN SPALTING »

Sara C. Robinson
Department of Wood Science & Engineering, Oregon State University
119 Richardson Hall, Corvallis, OR 97331, USA
sara.robinson@oregonstate.edu

Although the term 'spalting' is relatively new, the use of fungal-stained wood in woodcraft has a long history in Europe, dating as far back as the 1400s in Italian Intarsias and marquetry. The past twenty years have seen resurgence in popularity of this traditional wood coloring, with a renewed emphasis on stimulating specific fungal species to produce spalted wood for commercial sales. Direct inoculation of sound wood with live fungi has met with limited success, although this method of producing spalted wood remains the most popular. A much faster and more reliable method, however, has recently been developed for induced spalting whereby known spalting fungi are grown on either specialized Petri plates under laboratory conditions on in liquid cultures without agar. After growth the fungal pigments are collected and extracted utilizing dichloromethane (DCM), and then pigments reapplied using pressure treating (Fig 1) or direct application (Fig 2). These new methods have turned spalting from a several year process to one that takes several hours. Both application methods give much more control to where the pigments bind on the wood than with standard fungal inoculations, and do not result in any type of wood structural damage. Although testing of this type of spalting has not yet been done on a large scale, it holds strong potential not only for use in commercial-level spalting, but also for coloration of new media, such as paint, glass, and textiles.

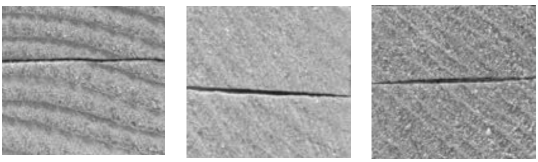


Figure 1 – Fungal pigments applied via pressure treating. Left: Abies procera with the green stain of Chlorociboria spp.; middle: Pinus contorta with yellow stain of Scytalidium ganodermophthorum; right: Pinus contorta with the pink stain of Scytalidium cuboideum

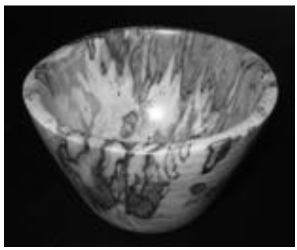


Figure 2 – Direct application of fungal pigments to a turned bowl

Notes