



WOOD IDENTIFICATION IN OBJECTS OF THE BAMBUTI PEOPLE FROM THE CONGO IN THE COLLECTION OF THE SLOVENE ETHNOGRAPHIC MUSEUM
IDENTIFIKACIJA LESA PREDMETOV LJUDSTVA BAMBUTI IZ KONGA V ZBIRKI SLOVENSKEGA ETNOGRAFSKEGA MUZEJA

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Abstract / Izvleček

Abstract: The African collection of the Slovene Ethnographic Museum (SEM) in Ljubljana, Slovenia, holds objects of everyday life from the Bambuti people from the Ituri forest, in the northeastern part of the Democratic Republic of the Congo. The items were collected by the anthropologist Paul Joachim Schebesta, possibly during his expeditions around 1930. The objects containing wood were selected for wood identification by using microscopic wood identification, with the help of the InsideWood database and reference samples from the xylarium of the Royal Museum for Central Africa in Tervuren, Belgium. The investigated musical instrument, a wooden zither, was made of wood of *Musanga cecropioides*, the handle of the shield of *Alstonia* sp., the dagger and sheath of *Autranella congolensis* or another high density species of Sapotaceae, and the crossbow of *Nauclea diderichii* (bow) and *Xylopi* sp. (stock). Wood identification helped us to gain additional information on the origin, knowledge of wood, and time of the collection of objects in the Congo.

Keywords: museum objects, wood identification, *Musanga cecropioides*, *Alstonia*, *Autranella congolensis*, *Nauclea diderichii*, *Xylopi*, Africa

Izvleček: Afriška zbirka Slovenskega etnografskega muzeja (SEM) v Ljubljani hrani predmete iz vsakdanjega življenja ljudstva Bambuti iz gozda Ituri, na severovzhodu Demokratične republike Kongo. Predmete je zbral antropolog Paul Joachim Schebesta med svojimi odpravami verjetno okoli leta 1930. Predmeti, ki so vsebovali adutni les, so bili izbrani za raziskavo in mikroskopsko identifikacijo lesa s podporo platforme InsideWood ter referenčne zbirke lesa Kraljevega muzeja za Srednjo Afriko v Tervurnu v Belgiji. Raziskano glasbilo (lesene citre) je bilo izdelano iz lesa vrste *Musanga cecropioides*, ročaj ščita iz vrste *Alstonia* sp., nožnica in bodalo iz *Autranella congolensis* ali sorodne vrste z visoko gostoto iz družine Sapotaceae, samostrel pa iz *Nauclea diderichii* (lok) in *Xylopi* sp. (ročaj). Identifikacija lesa je ponudila dodatne informacije o izvoru, poznavanju lesa in času zbiranja predmetov v Kongu.

Ključne besede: muzejski predmeti, identifikacija lesa, *Musanga cecropioides*, *Alstonia*, *Autranella congolensis*, *Nauclea diderichii*, *Xylopi*, Afrika

1 INTRODUCTION

1 UVOD

The Slovene Ethnographic Museum (SEM) in Ljubljana holds an African collection with objects collected by the anthropologist Paul Joachim Sche-

besta. They were possibly collected during his expeditions in 1929 and 1930 when he visited the Ituri rainforest on the Congo River and lived among the central African Pygmy people and explored their culture (Frelih et al., 2017).

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Paul Joachim Schebesta (Šebesta) was born in 1887 in Groß Peterwitz, Upper Silesia, at that time in the Austro-Hungarian Empire. During his studies in Mödling, near Vienna, he was dedicated to philosophy, theology, linguistics and ethnography. Under the influence of his professor, Wilhelm Schmidt, he developed a passion for studying the origin of religions which was later the main reason for his expeditions and extensive field research in Africa and Asia (Gütl, 2010). For this purpose, he searched for peoples who lived in remote, hard to reach areas and who were not yet affected by external influences from other cultures.

Schebesta undertook several research expeditions in the Congo (Figure 1). He was most attracted by the Bambuti (Mbuti) people in the rainforest on the Ituri catchment. In his first two expeditions in 1929 and 1930, he visited the Ituri rainforest, where the Pygmies had moved under pressure from other tribes (Schebesta, 1932). He was considered to be the first European who managed to live among the shy rainforest people for a significant period of time, and learned about their way of living, customs and traditions, which in some ways would be considered prehistoric in Europe (Frelih et al., 2017). The culture, which in the first half of 20th century was already in danger of becoming ex-

tinct, was important for exploration of the cultural history of mankind due to its ancientness.

The Pygmies from the Ituri rainforest in the Congo Basin seemed to have had a simple material culture, but they had impressive knowledge of flora, fauna and survival in the rainforest habitat. During his expeditions, Schebesta systematically documented and published what he observed (e.g., Schebesta, 1957). He also collected photographs, many of which are publicly available at the Bildarchiv Austria (2022) (Figure 1). He also systematically collected a selection of objects related to life of the investigated cultures, and presented his research through numerous lectures to the scientific community, students, and general public all over Europe (Frelih et al., 2017).

Schebesta's private collection, acquired during his fieldwork in the Congo, contained several thousands of objects, which he brought home to Mödling near Vienna. He later gradually gave or sold objects to museums in Brussels, Prague, and Vienna. However, it is less well known that a part of Schebesta's African collection is also kept in the Slovene Ethnographic Museum. Most likely it arrived there in October 1933, when Schebesta held a number of lectures in Ljubljana and other locations in Slovenia. He most likely donated the collection to

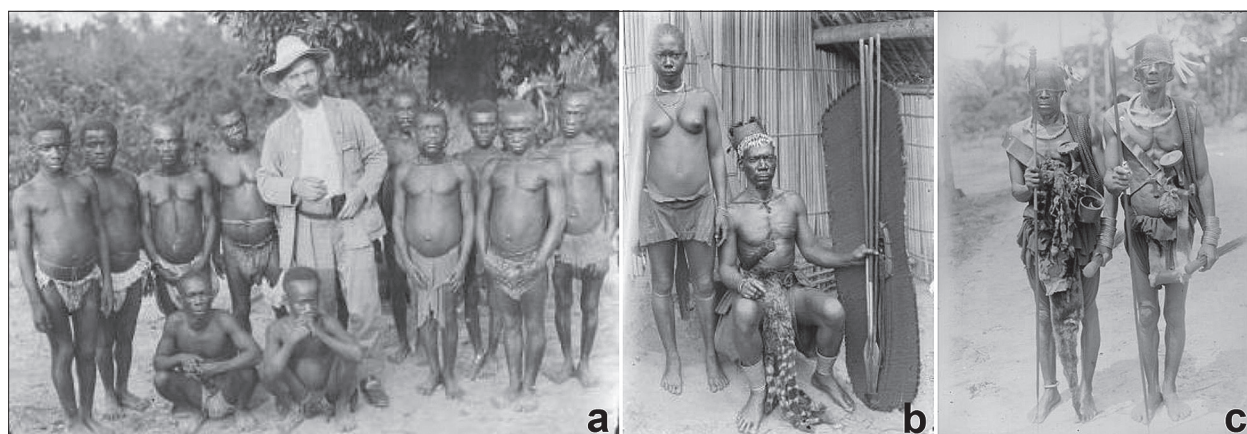


Figure 1. Photos from the archive of Paul Joachim Schebesta in the Bildarchiv Austria (2022): (a) Bambuti Pygmies in the village of Kero, with Schebesta surrounded by men (#10818394); (b) Bandaka Pygmies, specifically the headmen with his daughter, with the shield resembling the one investigated in this study (#12348274); (c) Nkundo Pygmies, with two men and weapons, including daggers like the ones in this study (#12452720)

Slika 1. Fotografije iz arhiva Paula Joachima Schebeste, ki ji hrani Bildarchiv Austria (2022): (a) Bambutiji v vasi Kero—Schebesta obkrožen z moškimi (#10818394), (b) ljudstvo Bandaka—poglavar s hčerjo—ščit je podoben tistemu, ki je bil raziskan v tej študiji (#12348274), (c) ljudstvo Nkundo—dva moška z orožjem, vključno z bodalom, podobnim bodalu v tej študiji (#12452720).



Figure 2. Some of the objects from the collection of Pavel Schebesta in the Slovene Ethnographic Museum (SEM) in Ljubljana (from Frelih et al., 2017).

Slika 2. Nekaj predmetov iz zbirke Pavla Schebeste, Slovenskega etnografskega muzeja (SEM) v Ljubljani (iz Frelih et al., 2017).

Professor Lambert Ehrlich, who lived and worked in Ljubljana. The existing sources also do not reveal when Ehrlich transferred the collection to the Slovene Ethnographic Museum, since two dates are mentioned – 1940 and 1941 – and whether he sold or donated the collection (Frelih et al., 2017). Due to these facts, it is extremely likely that the collection originates from the two expeditions Schebesta made to the Congo in 1929 and 1930.

Schebesta's collection at the Slovene Ethnographic Museum consists of 96 objects. Although it is not large, it contains a diversity of systematically collected objects, providing a basic presentation of the principal activities in the everyday life and material culture of different Bambuti groups native to the Ituri rainforest, Congo. The collection was not extensively researched or published until 2017, i.e. 130 years after Schebesta's birth and 50 years after his death, when the Slovene Ethnographic Muse-

um and the Slovene Museum of Christianity prepared an exhibition and publication entitled *Baba wa Bambuti*, the name Schebesta was given by the natives on the Ituri River (Frelih et al., 2017). In addition to objects from Schebesta's collection, an example of a wooden crossbow from the second half of the 19th century is also included in this research. The crossbow is from the Congo, and nothing is known about the collector.

The objects examined in this collection are mainly made of plant and animal material, and only few seem to be made of wood, which has not been investigated so far. In this study we thus focused on a few selected objects to perform wood research and identification. Our aim was to find out if such research can help answer various questions related to origin and history of the objects, and to explore how such information can help the museum curators.

2 MATERIALS AND METHODS

2 MATERIAL IN METODE

2.1 SELECTION OF MUSEUM OBJECTS

2.1 IZBOR MUZEJSKIH OBJEKTOV

In the depository of the Slovene Ethnographic Museum (SEM) in Ljubljana we inspected a list of objects from Schebesta's collection and selected ones that were presumably made of adult wood. The selected objects were a musical instrument (wooden zither), a shield, a dagger with sheath, and a crossbow consisting of bow and stock (Figure 2, Table 1). Each of the objects was carefully inspected by the museum curator, conservator-restorer and wood specialist in order to define the optimal location for sampling for wood identification.

For sampling we developed a minimally destructive method which allowed us to take small samples of wood to prepare thin microscopic slides (Koren, 2017). The wood samples were taken under the supervision of a museum curator and conservator on the least exposed and if possible hidden parts of the objects. For this purpose we used a special small drilling tool, an oscillating saw, and a surgical knife (Figure 3). The locations for wood sampling were carefully selected for each of the items, depending on its form and size. The samples contained enough wood tissue to produce cross-, radial-

and tangential sections for microscopic wood identification.

2.2 SAMPLE PREPARATION

2.2 PRIPRAVA VZORCEV

After sampling, the wood was softened in a mixture of distilled water, glycerol and ethanol (in a ratio of 1:1:1) for about one week. Afterwards, the samples were observed under a magnifying glass and oriented to define the anatomical planes for cutting cross-, radial- and tangential sections with the help of a Leica SM2000R sliding microtome equipped with steel knives. The thickness of the sections was 10-20 µm. In one case the sample was taken with a surgical knife (Figure 3) and was embedded in paraffin; in this case 9 µm thick sections were cut with a Leica RM 2245 rotary microtome. Finally, the sections were stained with a water mixture of safranin and astra blue (i.e., 40 mg safranin and 150 mg astra blue in 100 ml demineralized water and 2 ml acetic acid) for at least 20 min, then washed, gradually dehydrated in ethanol (50, 70 and 100%) and finally mounted in Euparal according to the standard procedure (e.g., Prisljan et al., 2022).

In this way, we produced one permanent slide for each of the objects or their parts, if they were made of more than one wood species.

Table 1. The investigated objects and their description from the catalogue (Frelih et al., 2017).

Preglednica 1. Preučevani objekti in njihov opis iz kataloga (Frelih et al., 2017).

Museum code Muzejska koda	Name Ime	Description Opis
EM 2953	Wooden zither	Musical instrument – a wooden zither with twelve plant-fibre strings (originally 15 strings).
	Lesene citre	Glasbeni instrument – lesene citre z 12 strunami iz rastlinskih vlaken (prvotno 15 strun).
EM 2866	Shield	Shield made of interwoven thin sticks and plant fibres with a carved handle plate, made of a single piece of wood and fixed to two vertical parallel sticks.
	Ščit	Ščit iz prepletenih tankih palic in rastlinskih vlaken z izrezljanim ročajem, izdelanim iz enega kosa lesa in pritrjenim na dve navpični vzporedni palici.
EM 2864	Dagger and sheath (scabbard)	Dagger with wooden hilt and iron blade, in a wooden sheath with an attached leather belt.
	Bodalo in nožnica	Bodalo z lesenim ročajem in železnim rezilom v leseni nožnici s pritrjenim usnjenim pasom.
EM 2675	Crossbow	Not in the catalogue/unknown collector from 19 th century.
	Samostrel	Ni v katalogu/ neznan zbiralec iz 19. stoletja.

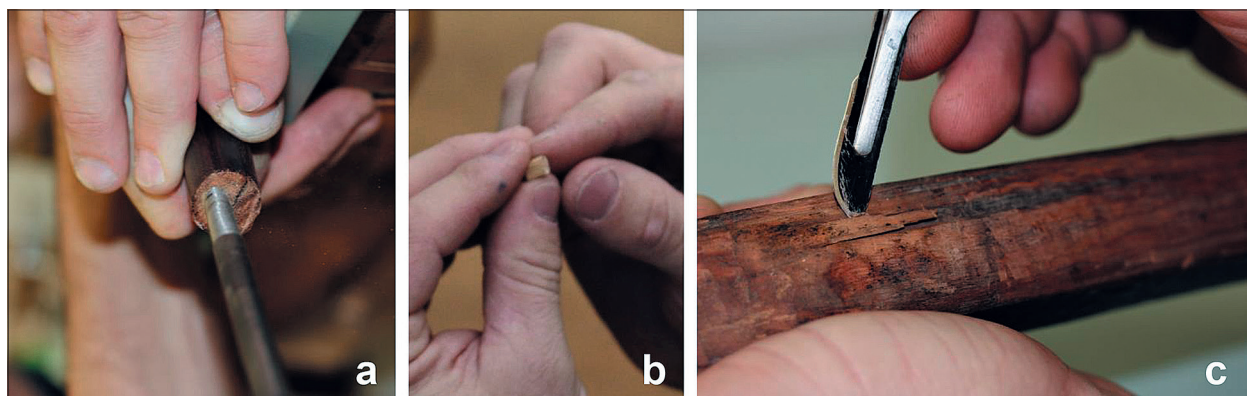


Figure 3. Collection of small samples for microscopic slides: (a) small drilling tool, (b) dimensions of wood sample, (c) collection of wooden splinter with a surgical knife.

Slika 3. Odvzem majhnih vzorcev za mikroskopske preparate: (a) majhno vrtalno orodje, (b) dimenzija lesene vzorca, (c) odvzem lesene trske s kirurškim skalpelom.

2.3 WOOD IDENTIFICATION

2.3 IDENTIFIKACIJA LESA

Microscopic wood identification was performed by observing the sections under a Nikon Eclipse E800 light microscope equipped with a Nikon DS-Fil digital camera and using the NIS Elements BR 3.0 image analysis computer program to capture the images. We examined the sections and recorded the observed features using the IAWA list of microscopic features for hardwood identification (IAWA committee, 1989) and InsideWood database (Wheeler, 2011; InsideWood, 2022). Afterwards the combinations of features were compared with reference data from the InsideWood database and xylarium of the Royal Museum of Central Africa, Tervuren, Belgium.

3 RESULTS AND DISCUSSION

3 REZULTATI IN RAZPRAVA

3.1 WOODEN ZITHER

3.1 LESENE CITRE

The musical instrument, a wooden zither (EM2953), was made of wood of low density. The body was about 70 cm long, 20 cm wide, and 2 cm thick, and the wood working was rough. The instrument contained twelve plant-fibre strings whereas the body had 15 incisions at each end, where the strings were attached (Figure 4). Two wooden sticks, about 2 cm thick, positioned between the strings and the body, were used for tensioning the

strings. They were not fixed, so their position could be changed to achieve the desired tone.

Based on its wood structure (Figure 5) the wood of the body was identified as *Musanga cecropioides* R. Br., Urticaceae, with the most frequently used common names being African corkwood or parasolier (InsideWood, 2022).

The wood is diffuse porous with indistinct or absent growth ring boundaries and large vessels (tang. diameter $\geq 200 \mu\text{m}$), thin walled fibres, paratracheal axial parenchyma (scanty, vasicentric), heterogeneous rays (body ray cells procumbent with 1-4 rows of upright and / or square marginal cells), 1-3 cells wide with sheath cells and prismatic crystals.

The species *Musanga cecropioides* grows in tropical Africa (PlantUse *Musanga*, 2022). Its wood is of low commercial importance and is not available on international markets. It has low density wood, with an air dry density of 190–370 kg/m³. The colour of the wood is basically white, sometimes with a pinkish tinge when freshly cut, turning to pale yellow or pale brown upon exposure. Heartwood cannot be distinctly demarcated from the sapwood. The wood is nondurable, class 5 (CEN, 2016), as reported by Wagenführ and Wagenführ (2022).

The wood belongs to one of the lightest ones in the central African forests. It is easy to cut and work. It is occasionally locally used for light interior constructions, partitions, doors, fences, roof rafters, stools, beds, musical instruments, toys,

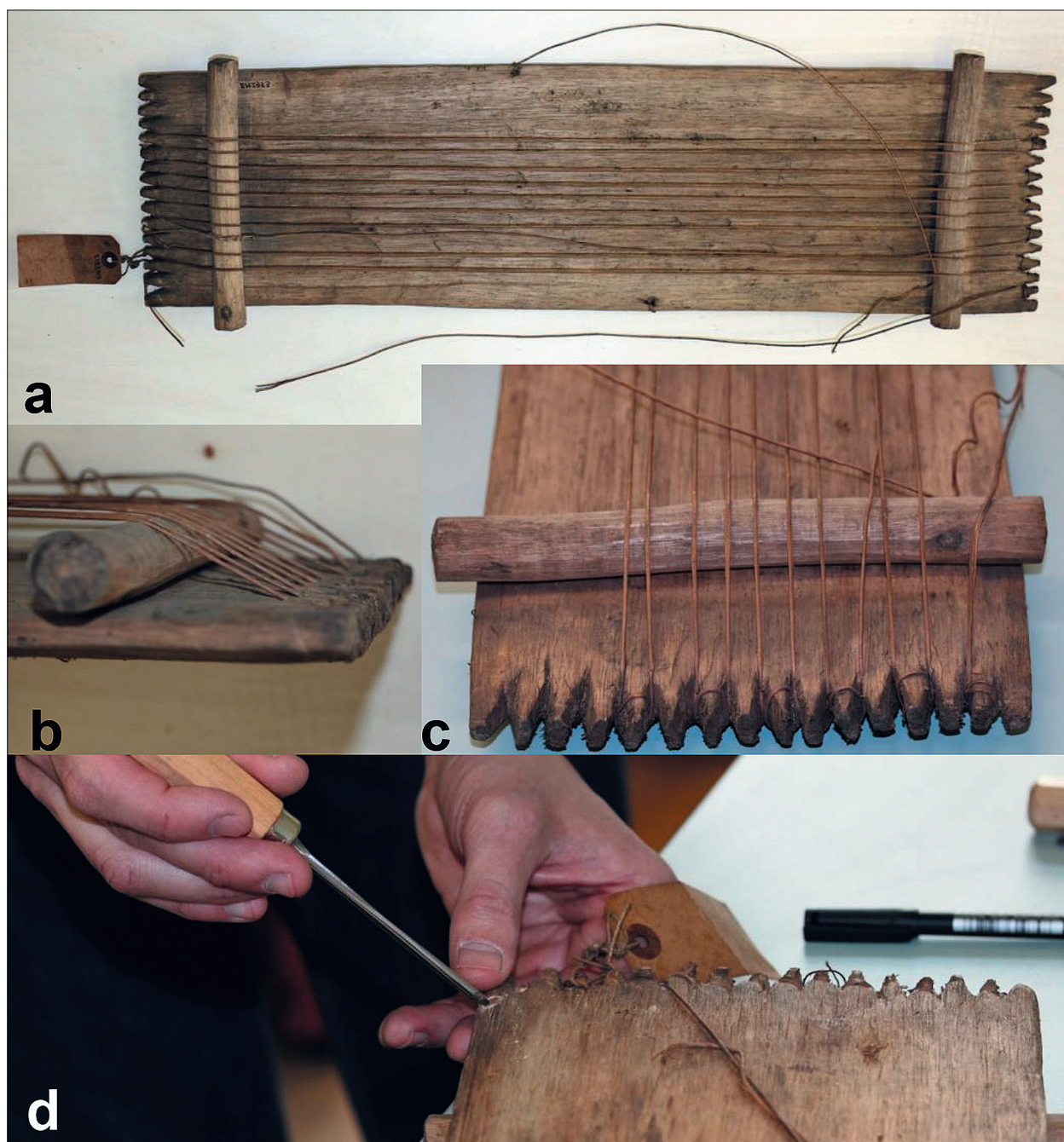


Figure 4. Wooden zither (length about 70 cm): (a) entire instrument, (b, c) details, and (d) location of wood sampling.

Slika 4. Lesene citre (dolžine približno 70 cm): (a) celoten instrument, (b, c) podrobnosti ter (d) mesto odvzema vzorca lesa.

walking sticks, paddles, trays, baskets, and as a cork substitute to make floats for fishing nets and small canoes. It is suitable for sporting goods, boxes, crates, carvings, veneer, plywood, hardboard, particle board and wood-wool. The wood is tradi-

tionally used to produce thin split boards. It can potentially be used as industrial insulation. The boles were traditionally hollowed out to make containers for liquids and small canoes, and to produce carved objects.

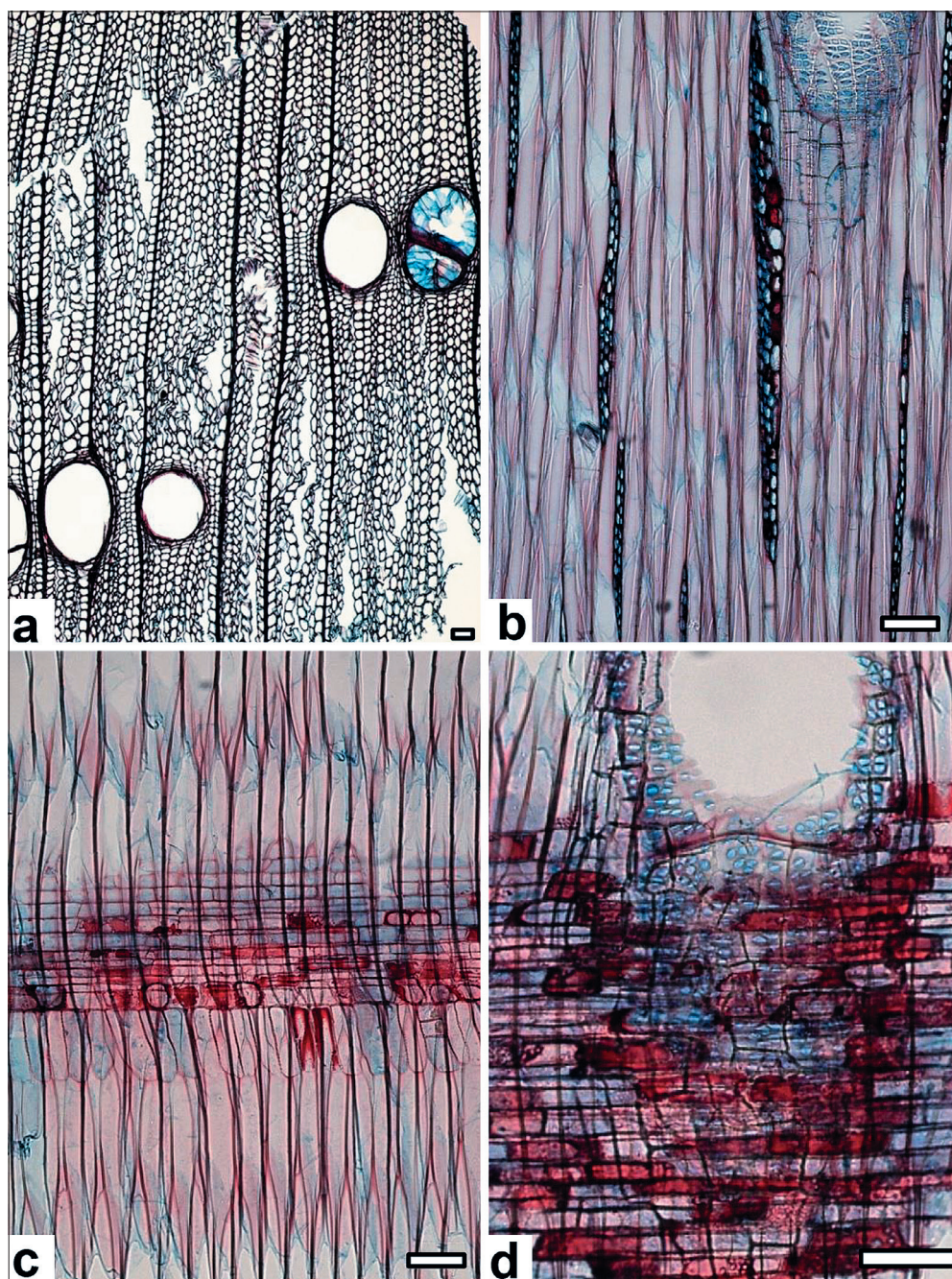


Figure 5. Wood from the body of the wooden zither *Musanga cecropioides* with: (a) cross-, (b) tangential-, and (c, d) radial sections. Scale bars—100 µm.

Slika 5. Les glavne- ga dela citer vrste *Musanga cecropioides*: (a) prečni, (b) tangencialni in (c, d) radialni pre- rez. Merilne daljice -100 µm.

Musanga cecropioides is an outspoken pioneer species, often growing on clear cuts or in disturbed areas in wetter forests and on small scale canopy-gaps, in regions with a mean annual temperature of 25–30°C and annual rainfall of 1300–2500 mm or more. The trees are generally characterized by quick growth, and are often found around villages and along roads. The species usually occurs below 800 m altitude, and in the Democratic Republic of Congo occasionally up to 1200 m (PlantUse *Musanga*, 2022).

3.2 THE SHIELD

3.2 ŠČIT

The shield is labelled EM2866 and is made of different types of plant material. The base of the shield is formed by two sticks, which support the handle and the front part (mask) of the shield, which is artificially made of intertwined plant material. The central sticks are positioned along the shield, which is about 140 cm long (Figure 6), and provide a quality construction solution to improve the strength of the shield. The central sticks are



Figure 6. The shield (length 140 cm): (a) front and (b, c) back view with the wooden handle.

Slika 6. Ščit (dolžine 140 cm): (a) sprednji in (b, c) zadnji del z lesenim ročajem.

connected by the handle and a skilfully made piece of interlaced plant material, which also serves for decoration. The handle is made of one piece of wood and is attached to the shield with a rope. The object is very light, and therefore was possibly used as a ceremonial shield.

The wood of the shield handle was identified as *Alstonia boonei* De Wild. or *A. congensis* Engl., Apocynaceae with the vernacular names cheese-wood, ekouk or emien. The two species cannot not be distinguished based on wood structure (InsideWood, 2022; PlantUse *Alstonia...*, 2022).

The wood is diffuse porous (Figure 7). Intervessel pits are vestured and vessel-ray pits similar to intervessel pits in size and shape appear throughout the ray cell, the fibres are very thin-walled, axial parenchyma is reticulate, aligned in narrow bands or lines up to three cells wide. Rays are one to three cells wide and heterogeneous, with procumbent body cells and one to four rows of upright and / or square marginal cells. Laticifers are present but they are very small (with a similar size to the ray cells) and difficult to distinguish in the ray on tangential section (Figure 7b) (InsideWood, 2022).

The heartwood is creamy white and indistinctly demarcated from the up to 20 cm wide sapwood. The wood darkens upon exposure to light. The grain is straight, occasionally wavy, and the texture moderately coarse. Growth rings are indistinct or absent. The wood has a disagreeable smell when green. It is lightweight, and the mean air-dry density is 360 kg/m³. The wood is not durable and belongs to durability class 5 (CEN, 2016). The wood is easy to saw, although the presence of latex may cause clogging of sawblades (CIRAD *Alstonia*, 2022; PlantUse *Alstonia boonei*, 2022; PlantUse *Alstonia congensis*, 2022).

The wood of *Alstonia boonei*, called alstonia in international trade, is used for light constructions, light carpentry, open boats, moulding, furniture, interior joinery, implements, boxes, crates, matches, pencils, sculptures, and for veneer and plywood. It is locally popular for the production of household implements because of its good working properties and stability. It is easy to carve therefore it is also used for masks, sculptures and so on.

The genus *Alstonia* comprises about 40 species with a pantropical distribution. Only two, *Alstonia congensis* and *Alstonia boonei*, are indigenous in

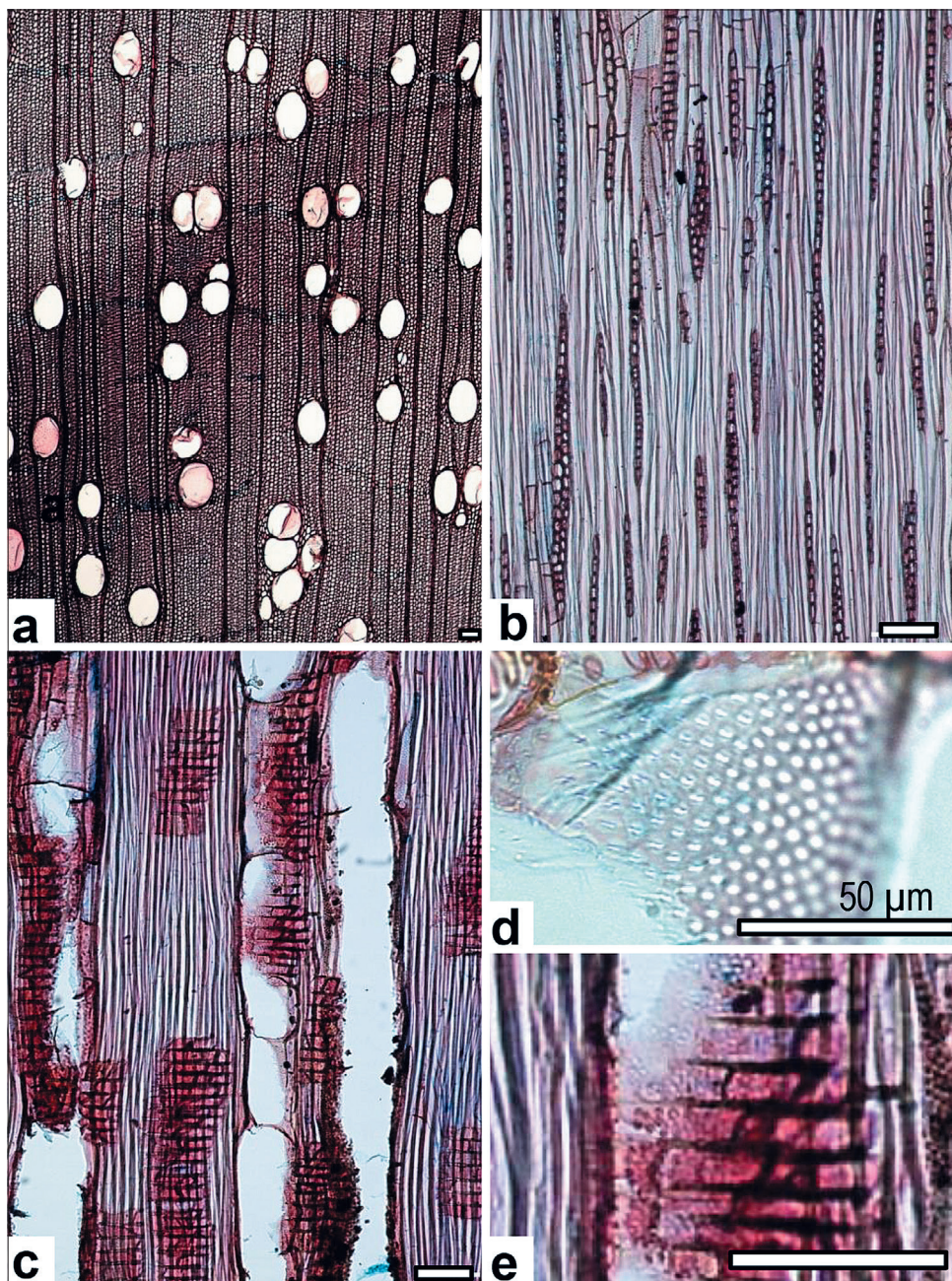


Figure 7. Wood of *Alstonia* sp. from the shield handle: (a) cross-, (b) tangential-, and (c) radial sections, (d) vestured intervessel pits, (e) detail showing vessel ray pits. Scale bars—a, b, c, e—100 μ m, d—50 μ m.

Slika 7. Les ročaja štita vrste *Alstonia* sp.: (a) prečni, (b) tangencialni in (c) radialni prerez, (d) okrašene intervaskularne piknje, (e) pogled, kjer so vidne piknje med trakom in trahejo. Merilne daljice: a, b, c, e—100 μ m, d—50 μ m.

Africa. The wood of the two species is closely related, and the two species are not discriminated in use.

3.3 DAGGER AND SHEATH

3.3 BODALO IN NOŽNICA

The dagger with a wooden hilt, iron blade and a wooden sheath (EM2864) is a decorated object which could be produced and used for ritual purposes (Figure 8). Macroscopic inspection of the wood revealed that the hilt and sheath were

made of the same wood species. The sheath is approximately 35 cm long and is made of one piece of wood. It contains a precisely made opening which fits the blade of the dagger. A leather belt is attached through a hole and enables fitting the objects around the waist. The sheath is made with exceptional precision, which is evident from the wood processing, decoration and precise dimensions. The dagger with an about 30 cm long blade and over 10 cm long wooden hilt is also precisely made. The blade is decorated with cuts. The pom-



Figure 8. Dagger with a wooden hilt and iron blade, and a wooden sheath with leather belt.
Slika 8. Bodalo z lesenim ročajem in železnim rezilom ter leseno nožnico z usnjnim pasom.

mel of the hilt is decorated with bronze rivets. One of the photos taken by Paul Joachim Schebesta shows two warriors of the Nkundu people in full gear, including a dagger, similar to the one investigated in this study (Figure 1c).

The wood of the dagger hilt and sheath was identified as similar to *Autranella congolensis* A. Chev., Sapotaceae, with the most common vernacular names being elang and mukulungu (InsideWood, 2022).

This diffuse-porous wood species with small vessels (Figure 9) has the following features: intervessel pits alternate, vessel-ray pits with much reduced borders to apparently simple pits rounded or angular, non-septate fibres present, fibres very thick-walled, axial parenchyma diffuse and diffuse in aggregates, axial parenchyma in narrow bands or lines up to three cells wide (mainly one cell wide), eight (five to eight) cells per parenchyma strand, ray width one to three cells, body ray cells procum-

bent with mostly two to four rows of upright and / or square marginal cells, body ray cells procumbent with over four rows of upright and / or square marginal cells (InsideWood, 2022).

The wood has a high air-dry density (940 kg/m³). The heartwood is red brown and can be clearly distinguished from sapwood. The wood is very durable, class 5 (CEN, 2016). The wood is used for hydraulic works, sleepers, heavy constructions, poles, heavy carpentry, flooring, stairs, sliced veneer, exterior panelling, and cooperage (CIRAD, *Autranella congolensis*, 2022).

Autranella congolensis occurs in primary evergreen rainforest, and is usually scattered, rarely abundant. Natural regeneration is currently poor. The growth of trees is slow and very long cutting cycles are probably required for sustainable harvesting. This makes *Autranella congolensis* a tree with few prospects for timber production, and attention should concentrate on its protection.

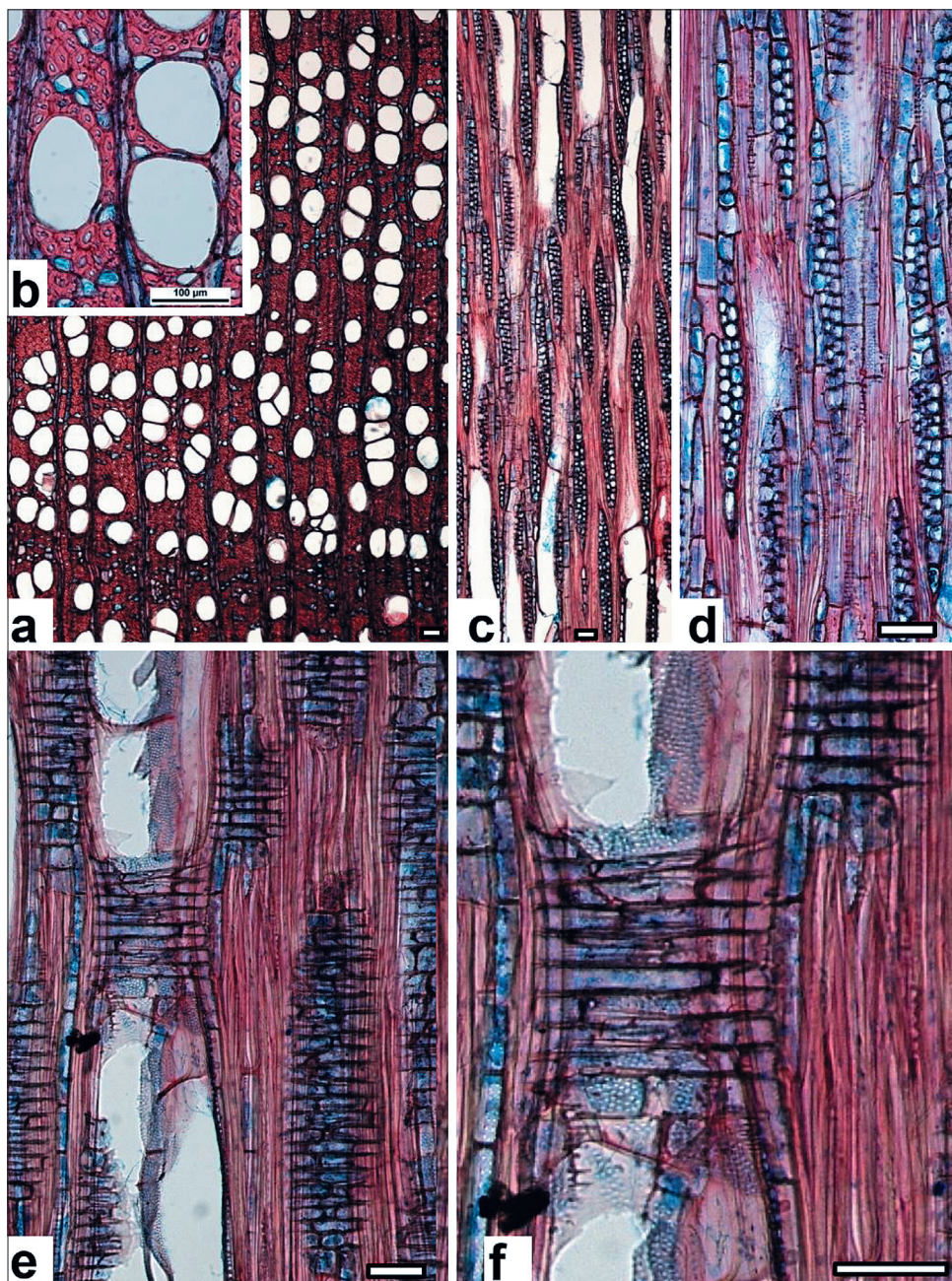


Figure 9. Wood from the dagger hilt and sheath, *Autranella congolensis*, Sapotaceae with (a, b) cross-, (c, d) tangential-, and (e, f) radial sections. Scale bars—100 μ m.

Slika 9. Les ročaja in nožnice bodala iz lesa vrste *Autranella congolensis*, Sapotaceae: (a, b) prečni, (c, d) tangencialni in (e, f) radialni prerez. Merilne daljice—100 μ m.

3.4 CROSS-BOW

3.4 SAMOSTREL

The cross-bow (label EM 2675) is entirely made of wood and consists of two parts, a bow and handle (stock) (Figure 10). Based on the macroscopic examination, we supposed that the two parts must be made of two different wood species. The handle is about 120 cm long. Approximately two-thirds of its length is the trigger mechanism. From the structural point of view, the trigger mechanism is remarkably well made (Frelj et al., 2017). The han-

dle is evenly split into two parts, all the way to the chisel for the bow string. The bow is about 80 cm long. It is made of one piece of bent wood. As the distance between both ends of the bow and the incisions for the string are short, it is necessary to use a wood of exceptional toughness to produce an effective weapon.

The wood of the bow is identified as *Nauclea diderrichii* Merr., Rubiaceae, with the most common vernacular names being bilinga and opepe.

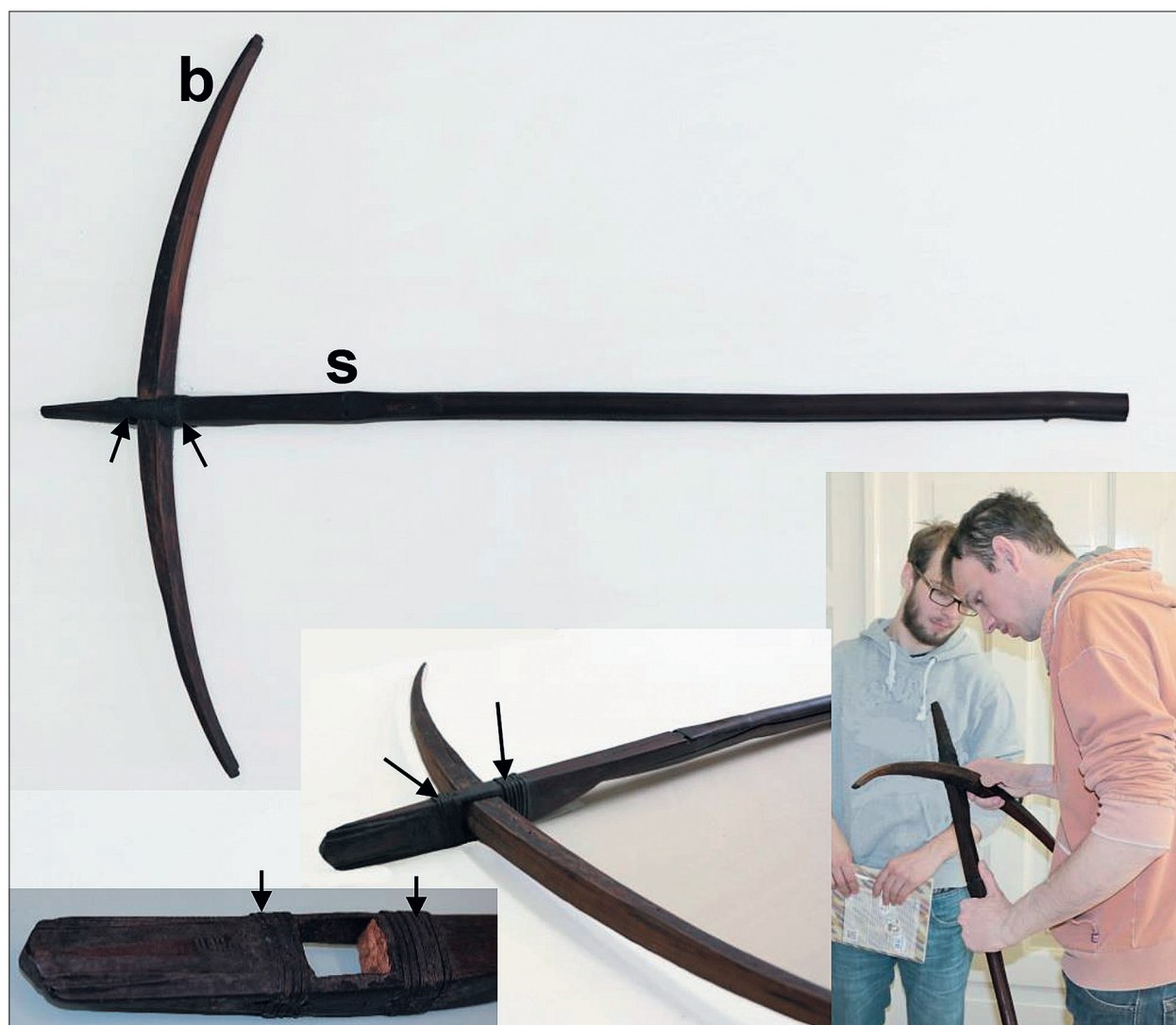


Figure 10. Crossbow – different views showing: (b) the bow made of *Nauclea diderichii* and (s) the stock made of *Xylopia* sp.; arrows show iron belts for reinforcement.

Slika 10. Samostrel, različni pogledi: (b) lok iz lesa *Nauclea diderichii* in (s) ročaj iz lesa vrste *Xylopia* sp.; puščice kažejo železne trakove za ojačitev.

This wood species is diffuse porous and has very small, isolated vessels (Figure 11). Other IAWA features of the species are: vessel-ray pits with distinct borders that are similar to intervessel pits in size and shape throughout the ray cell, bordered pits in fibres can be seen in radial and also in tangential fibre walls, axial parenchyma is diffuse, diffuse-in-aggregates or scanty paratracheal, ray width one to three cells. Rays have multiseriate portion(s) as wide as uniseriate ones, body ray cells are procumbent with mostly two to four or over four rows of upright and / or square marginal cells

orperforated ray cells, and the ray-body cells are procumbent.

Nauclea diderichii is on the list of commercial hardwoods (Richter and Dallwitz, 2002; CIRAD, *Nauclea diderrichii*, 2022). Its heartwood is golden yellow or orange yellow, clearly demarcated from the sapwood. Its wood is hard, dense (average air-dry density 760 kg/m³) and very durable, in durability class 1 (CEN, 2016), and it is resistant to fungi and insects (CIRAD, *Nauclea diderrichii*, 2022). It is used in joinery, flooring and marine constructions.

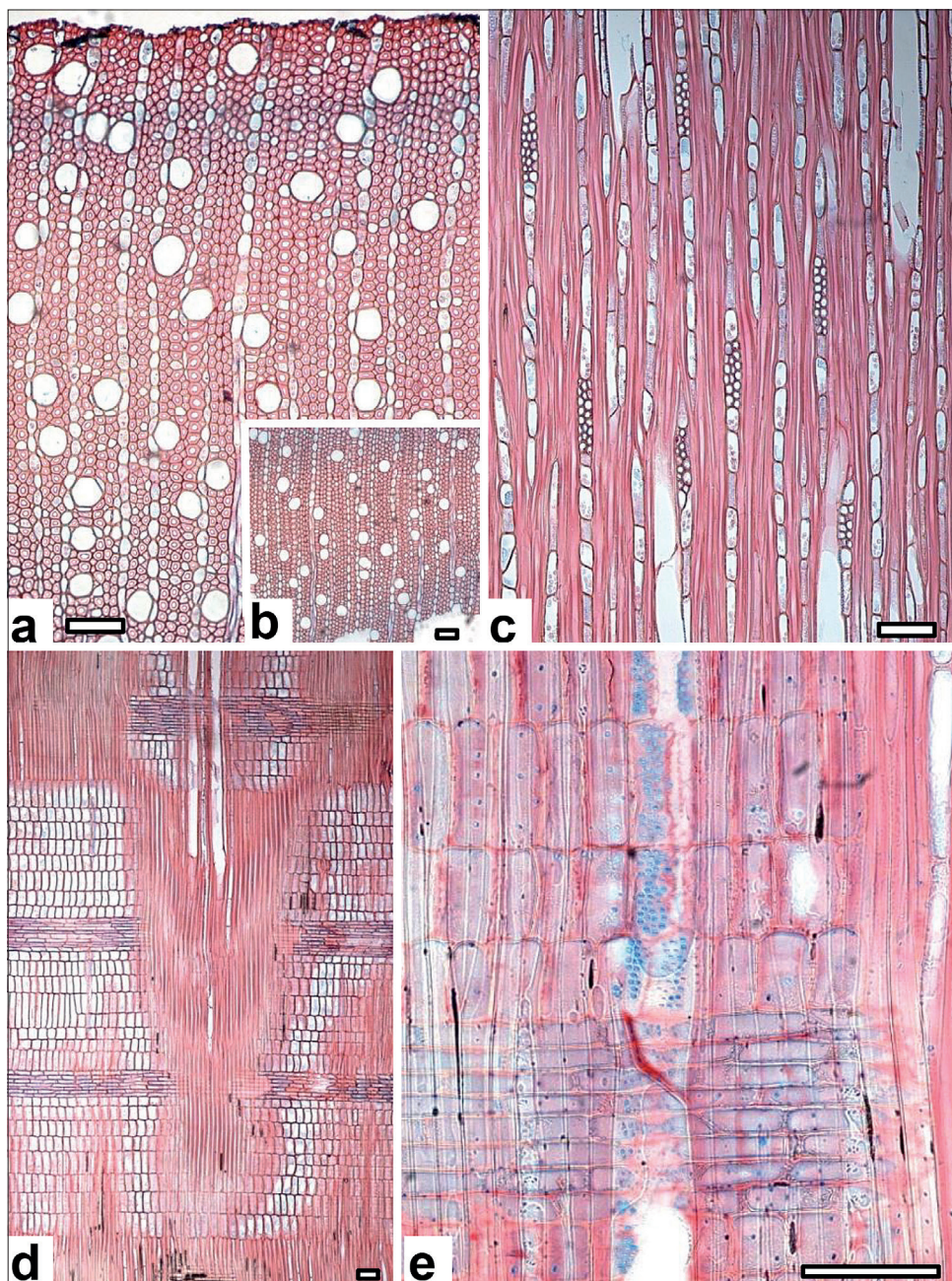


Figure 11. Wood from the bow of the cross-bow (*Nauclea diderichii*): (a, b) cross-, (c) tangential- and (d, e) radial sections; (d) detail showing vessel ray pits and pits in fibres. Scale bars—100 μm .

Slika 11. Les iz loka samostrela (*Nauclea diderichii*): (a, b) prečni, (c) tangencialni in (d, e) radialni prerez; (d) detajl s piknjami med trakom in trahejo in piknjami vlaken. Merilne daljice—100 μm .

It is used for railway sleepers, heavy carpentry, poles, heavy constructions, hydraulic works, flooring, cabinetwork, sliced veneer, ship building, planking and panelling (CIRAD, *Nauclea diderichii*, 2022). It was as a rule also used for numerous ethnographic objects.

Nauclea diderichii is a tree species natural in subtropical or tropical moist lowland forests. It is threatened by habitat loss (IUCN, 2022).

The wood of the stock belongs to the genus *Xylopia*, Annonaceae and we could not identify it to a

species level. The wood is diffuse-porous with radial diameters of vessels of ca. 200 μm . Vessel-ray pits have distinct borders and are similar to intervessel pits in size and shape throughout the ray cell. Fibres have simple to minutely bordered pits. Fibres are thick-walled. Axial parenchyma is in narrow bands or lines up to three cells wide, reticulate. Ray width is one to three, all ray cells are procumbent. Density is medium, 400-750 kg/m^3 (InsideWood, 2022).

Wood structure with a great proportion of thick-walled fibres and a homogenous struc-

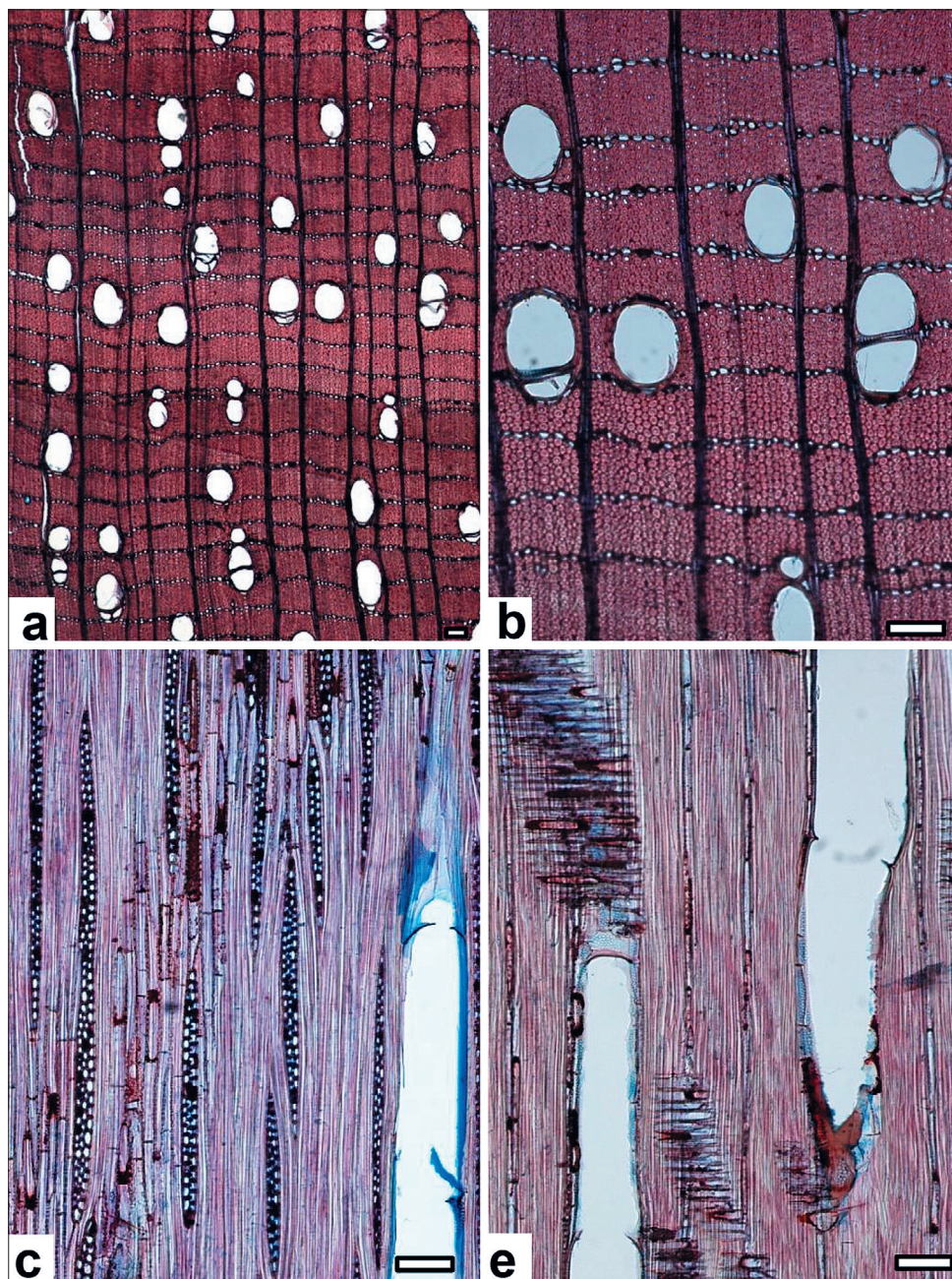


Figure 12. Wood from the stock of the crossbow (*Xylopiya* sp.): (a, b) cross-, (c) tangential-, and (d) radial sections. Scale bars—100 μ m.

Slika 12. Les ročaja samostrela (*Xylopiya* sp.): (a, b) prečni, (c) tangencialni in (d) radialni prerez. Merilne daljice—100 μ m.

ture with uniformly distributed axial parenchyma strands indicate that the wood may have a high density and favourable mechanical properties.

Up to twenty different species of *Xylopiya* grow in the Congo. Although the trees can be large enough to be used as timber, the wood is relatively unknown in international markets, but has some commercial potential if available in significant stocks. The wood is moderately hard and heavy, moderately durable to durable, of durability class 2-3 (CEN, 2016), and has good machining

characteristics, as shown for *Xylopiya hypolampsa* from the forests of the Central African Republic (Možina & Torelli, 1977; Torelli, 1983; Čufar, 1984). Wood of *Xylopiya* sp. has some decorative value for applications such as parquet flooring and furniture (Dahms, 1999). One species growing in the Ituri forest that is a candidate for the botanical identity of the crossbow is *Xylopiya chrysophyllum*.

3.5 POTENTIAL OF WOOD RESEARCH IN MUSEUM OBJECTS

3.5 POTENCIAL RAZISKAV LESA MUZEJSKIH OBJEKTOV

The collection of 96 objects from the SEM contained only few objects which were made of wood of larger trees. Nearly all of these objects have inventory labels (Figure 2), featuring their names and how the natives possibly used them. Interestingly, the labels show two, three, or even four different inventory numbers, written with different pens. Schebesta probably inventoried and numbered the objects in the field, but they were later renumbered in Mödling, and perhaps finally once more in Ljubljana (Frelih et al., 2017). The pictures from Schebesta's archive stored in the picture archive Bildarchiv Austria (2022) additionally help us to understand the use of the objects (Figure 1).

The wood of the objects has never been studied, so its potential to shed light on the wood species used by the Bambuti and to provide additional information on the origin and history of the objects could not be exploited.

In four studied objects, we identified five different species (Table 2) from different families, all of which grow in the tropical rainforest of Ituri in the Congo. The species are mostly unknown in international markets. They have different densities and other characteristics, and have been effectively

used to make various objects, confirming that their characteristics are well known to the local people, the Bambuti.

The choice of species confirms the origin of the wood from the Congo, more precisely from the dense tropical rainforest of Ituri. Since the species are not known internationally and have never been used in Slovenia, their identification could only be done by making high quality microscopic sections for observation under a microscope. This required destructive sampling, which in our case was less invasive because the process was optimized and very small wood particles were taken. Despite high quality microscopic sections, identification could not be done without the InsideWood collection and collaboration with the Royal Museum of Central Africa and its xylarium, with collections of wood samples and microscopic slides.

The objects in the Ljubljana collection resemble numerous objects in the Weltmuseum Wien in Vienna. Archival sources indicate that the objects in Vienna originate from the Congo region and come from Schebesta's expeditions in 1929-1930 and 1934-35 (Frelih et al., 2017).

Our enquiries in Austria and Belgium have shown that systematic identification of the wood of ethnographic objects from the Schebesta collection has mostly not been carried out, as also observed for other African collections (e.g., Bontadi & Bern-

Table 2. Wood taxa in the wooden objects from the museum collection and main information; *density of air-dry wood from the literature.

Preglednica 2. Vrste lesa v lesenih predmetih iz muzejske zbirke in glavni podatki; *gostota zračno suhega lesa iz literature.

Name and museum code Ime in muzejska koda	Wood species Vrsta lesa	Family Družina	Density* Gostota*
			kg/m ³
Wooden zither EM 2953 Lesene citre	<i>Musanga cecropioides</i>	Urticaceae	190–370
Shield (handle) EM 2866 Ščit (ročaj)	<i>Alstonia boonei</i> <i>Alstonia congensis</i>	Apocynaceae	360
Dagger and sheath EM2864 Bodalo in nožnica	<i>Autranella congolensis</i>	Sapotaceae	940
Crossbow EM 2675 Samostrel			
-bow / lok	<i>Neuclea diderichii</i>	Rubiaceae	760
-stock / ročaj	<i>Xylopi</i> sp.	Annonaceae	possibly >750

abei, 2016; Petrovčič, 2016). However, at least the botanical identity of a few objects from the material culture of the Bambuti is known, thanks to the research of Tanno (1981), who analysed their plant use with particular reference to their material culture and the use of wild vegetables as food.

Since the Bambuti had to move their camps regularly, their baggage was rather light. The men carried only the hunting equipment and axes, while the women carried the household items in baskets. Other items were shared with other families and used by the group as a whole, or made locally when needed (Tanno, 1981). The number of items in the material culture of the Bambuti is rather limited compared to that seen with sedentary cultures, but they testify to a close connection with nature and natural resources, and to an exceptional knowledge of forest products, including the wood characteristics of various trees, which were used for a wide range of applications.

4 CONCLUSIONS

4 SKLEPI

Although the Congolese indigenous objects collected by anthropologist Paul Joachim Schebesta are stored in several museums throughout Europe, and his missions to the Congo are well documented, the identification of wood in the objects has generally not been undertaken.

This study shows that five different wood species – namely *Musanga cecropioides*, *Alstonia boonei* or *Alstonia congensis*, *Autranella congolensis*, *Neuclea diderichii*, and *Xylopia* sp. – were identified in four studied objects. They all grow in the tropical rainforest of Ituri, Congo, and are largely unknown in international markets. Their identification could therefore only be achieved by making high quality microscopic sections and carrying out microscopic wood identification with the help of the InsideWood database and the wood collection of the Royal Museum of Central Africa. Wood research has thus helped us to obtain additional information on the origin and history of objects representative of the material culture of the Bambuti. The selection of wood species confirms their excellent knowledge of the wood properties of species growing in the Ituri rainforest habitat.

5 SUMMARY

5 POVZETEK

Slovenski etnografski muzej (SEM) v Ljubljani hrani zbirko predmetov, ki jih je zbral antropolog Paul Joachim Schebesta na svojih odpravah v Kongu, verjetno v letih 1929 in 1930, ko je obiskal deževni gozd Ituri ob reki Kongo in živel med srednjeafriškimi Pigmejci ter raziskoval njihovo kulturo (Frelih et al., 2017). Sistematično zbrani predmeti so povezani z življenjem raziskovanih kultur, ki jih je predstavil v številnih publikacijah in predavanjih po Evropi (Frelih et al., 2017). Veliko zbranih predmetov je postopoma podaril ali prodal muzejem v Bruslju, Pragi in na Dunaju, del Schebestove afriške zbirke pa hrani tudi SEM v Ljubljani. Najverjetneje je tja prišla oktobra 1933, ko je imel Schebesta predavanja v Ljubljani in drugih krajih v Sloveniji. V raziskavo smo vključili tudi leseni samostrel iz Konga, ki ga je muzej pridobil v drugi polovici 19. stoletja. Kdo je muzeju izročil samostrel, ni znano.

Schebestova zbirka v SEM obsega 96 predmetov, ki omogočajo osnovno predstavitev glavnih dejavnosti v življenju in materialni kulturi različnih skupin ljudstva Bambut, ki živijo v deževnem gozdu Ituri. Predmeti so večinoma izdelani iz rastlinskega in živalskega materiala. Le nekaj predmetov je izdelanih iz lesa večjih dreves. Les doslej še ni bil raziskan. V tej študiji smo se osredotočili na izbor in raziskavo lesenih predmetov, kjer smo opravili identifikacijo lesa. Zanimalo nas je tudi, ali lahko raziskave lesa prispevajo k razjasnitvi vprašanj, povezanih z izvorom in zgodovino predmetov, ter kako lahko pomagajo muzejskim kustosom.

V depoju SEM smo pregledali nabor predmetov in izbrali tiste, ki so domnevno izdelani iz adultnega lesa dreves. Izbrali smo štiri predmete: leseno glasbilo–citre, ščit z lesenim ročajem, bodalo z nožnico in samostrel, sestavljen iz loka in ročaja (preglednica 1, slike 2, 4, 6, 8, 10). Vsak predmet so skrbno pregledali muzejski kustos, konservator–restavrador in strokovnjaki za les, da bi določili optimalno mesto za odvzem vzorcev za identifikacijo lesa.

Za odvzem lesa smo razvili metodo, ki je omogočila odvzem majhnih vzorcev, mikroizvrtkov ali trsk, za pripravo tankih mikroskopskih preparatov. Vzorce lesa smo pod nadzorom muzejskega kustosa in konservatorja odvzeli na čim bolj skritih delih predmetov. V ta namen smo uporabili posebno

majhno orodje za vrtnanje, vrtalnik in nihajno žago ter kirurški nož (slika 3).

Pripravljeni so bili trajni mikroskopski preparati treh anatomskih ravnin, mikroskopska identifikacija lesa pa je bila opravljena s pomočjo platforme Inside Wood ter referenčnih vzorcev lesa in preparatov iz zbirke Kraljevega muzeja za Srednjo Afriko v Tervurnu v Belgiji.

Po odvzemu vzorcev smo les nekaj dni mehčali v mešanici destilirane vode, glicerina in etanola. Nato smo vzorce opazovali pod povečevalnim steklom in jih orientirali ter določili smer rezanja za pridobitev prečnih, radialnih in tangencialnih rezin. Rezine debeline 10–20 μm smo odrezali s pomočjo drsnega mikrotoma Leica SM2000R. V enem primeru je bil vzorec odvzet s kirurškim nožem (slika 3) in vklopljen v parafin (Prislan et al., 2022). V tem primeru so bili z rotacijskim mikrotomom Leica RM 2245 narezani 9 μm debeli preparati, ki smo jih obarvali z vodno raztopino barvil safranin in astra modro, izprali, dehidrirali in nazadnje vklopili v Euparal po standardnem postopku. Na ta način smo izdelali po en trajni preparat (prečni, radialni in tangencialni prerez) za vsak predmet ali njegov del, če je bil narejen iz več kot ene vrste lesa.

Za mikroskopsko identifikacijo lesa smo uporabili svetlobni mikroskop Nikon Eclipse E800, opremljen z digitalnim fotoaparatom Nikon DS-Fil in računalniškim programom za analizo slik NIS Elements BR 3.0. Preparate smo pregledali in poiskali znake za mikroskopsko identifikacijo lesa (IAWA Committee, 1989) ter opravili identifikacijo s pomočjo računalniškega ključa podatkovne zbirke Inside Wood (Wheeler, 2011; Inside Wood, 2022). Identifikacijo lesa smo opravili na osnovi kombinacije anatomskih znakov. Po oceni rodu ali lesne vrste smo opravili natančne primerjave z referenčnimi podatki in slikami iz zbirke Inside Wood in z referenčnim materialom iz ksilarija Kraljevega muzeja Srednje Afrike v Tervurnu. Tako smo potrdili ali izboljšali predhodno identifikacijo, opravljeno v okviru diplomske naloge (Koren, 2017).

Raziskali smo les štirih predmetov. To so glasbilo–lesene citre, ščit z lesenim ročajem, bodalo in nožnica ter samostrel, izdelan iz dveh sestavljivih delov, loka in ročaja. Predmeti so prikazani na slikah 1, 2, 4, 6, 8 in 10.

Raziskano glasbilo–lesene citre–je bilo izdelano iz lesa vrste *Musanga cecropioides*, ki ima go-

stoto zračno suhega lesa 190–370 kg/m^3 , uspeva v tropski Afriki in ni trgovsko pomemben.

Lažji ščit, narejen iz rastlinskih materialov, ki je imel verjetno obredni pomen, je imel ročaj iz lesa iz rodu *Alstonia* (*Alstonia boonei* ali *Alstonia congensis*). Rod *Alstonia* vsebuje okoli 40 vrst, od tega samo omenjeni vrsti uspevata v Afriki. Vrsti *Alstonia boonei* in *Alstonia congensis* sta zelo sorodni, njunega lesa pa ni mogoče zanesljivo razlikovati. Les gostote okoli 360 kg/m^3 je biološko neodporen in je priljubljen za lažje konstrukcije.

Bodalo z lesenim ročajem in leseno nožnico je iz lesa vrste *Autranella congolensis* ali sorodne vrste z visoko gostoto iz družine Sapotaceae. Gostota zračno suhega lesa je okoli 940 kg/m^3 . Les ima obarvano jedrovino in je odporen proti biološkim škodljivcem.

Samostrel ima lok, narejen iz vrste *Nauclea diderichii*, ki je na seznamu komercialnih lesnih vrst. Les ima visoko gostoto 760 kg/m^3 in zlato do oranžno rumeno jedrovino. Je trd in trden ter odporen proti biološkim škodljivcem. Ročaj samostrela je narejen iz lesa ene od vrst iz rodu *Xylopia*. V Demokratični republiki Kongo uspeva okoli 20 vrst iz rodu *Xylopia*. Ena od vrst, ki uspeva v gozdu Ituri, je *Xylopia chrysophyllum*. Les vrst *Xylopia* je v splošnem srednje gostote 400–750 kg/m^3 in je malo znan na mednarodnih trgih. Raziskovalci z Oddelka za lesarstvo so podrobneje raziskali les vrste *Xylopia hypolampsa* iz Centralnoafriške republike (CAR) (Možina & Torelli; Torelli, 1983; Čufar, 1984), ki so poleg anatomije ter fizikalno mehanskih lastnosti raziskali tudi njegovo obdelavnost. Centralnoafriški Pigmejci so les vrste *Xylopia hypolampsa* zaradi izjemne žilavosti uporabljali za izdelavo strelskih lokov in samostrelcev (Torelli, osebna komunikacija).

Za vsako od ugotovljenih lesnih vrst so prikazane slike treh anatomskih prerezov s tipičnimi mikroskopskimi znaki, ključnimi za identifikacijo lesa (slike 5, 7, 9, 11, 12). Vsaka od vrst je tudi opisana z vidika lastnosti in rabe lesa (preglednica 2).

Ugotovljene vrste lesa večinoma niso predmet mednarodne trgovine in niso široko znane. Njihova identifikacija ne bi bila mogoča brez baze podatkov za identifikacijo lesa listavcev Inside Wood in primerjav z lesom in preparati iz zbirke Kraljevega muzeja za Srednjo Afriko v Tervurnu.

Čeprav so predmeti, ki jih je zbral antropolog Paul Joachim Schebesta, shranjeni v več muzejih

po Evropi in so njegove misije v Kongu dobro dokumentirane, identifikacija lesa predmetov doslej v glavnem še nikjer ni bila opravljena.

Ta študija kaže, da je bilo v štirih preučevanih predmetih mogoče identificiranih pet različnih vrst lesa, ki vse rastejo v tropskem deževnem gozdu Ituri v Kongu in so na mednarodnih trgih precej neznane. Raziskave lesa so tako pomagale potrditi izvor lesa in nudijo dodatne podatke o domnevni zgodovini predmetov, ki predstavljajo materialno kulturo ljudstva Bambuti. Izbor lesnih vrst potrjuje, da so domačini odlično poznali drevesne vrste in lastnosti lesa vrst, ki uspevajo v deževnem gozdu Ituri.

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