

## 5) 鳥類剥製標本の安定化処理および修復

鳥類剥製標本は、博物館などで生態を紹介するための「展示用剥製(本剥製)」と、学術研究のために保存される「学術標本(仮剥製)」の大きく二種類に分けられます(図1)。学術標本は、形態の計測や、羽毛の色彩等を比較しやすいようにするため、直立の形で簡便に製作されます。一方、生態を紹介するための展示用剥製は、様々なスタイルで保存するため、頭部および翼や脚を支える針金や木毛(木材を細く削った糸状のもの)、真綿や粘土といった材料を剥製内部に用いるため、構造が複雑になります(坂本1931、橋本1977)。

今回、津波によって被災し、救出された陸前高田市立博物館所蔵の鳥類剥製標本(以下、剥製)のほとんどが展示用剥製でした。泥の中から発見された剥製は、まず一次洗浄(外部に付着した泥等を洗浄し、乾燥したもの。熊谷ほか〔2013〕参照)を終えてから山階鳥類研究所に持ち込まれました。多くの剥製は翼や脚、頭部など、胴体部分から離れた部分の破損の程度が著しく、そこから泥や海水が内部に侵入して、中に詰められている綿や木毛を汚染し、カビの発生源となっていました。これらの剥製を修復するためには、一度、剥製を分解して、中に詰められている材料を交換する必要がありました。これまで、剥製標本の修復は主に、脱落した羽毛の接着や、足や嘴等の破損を修復するなど、鳥体外部へ施す作業でした。剥製を解体して再構築する作業の経験はなく、これらの修復作業を行うに

### 5) Stabilization and Restoration of Stuffed Bird Specimens

Stuffed bird specimens are broadly classified into two groups: specimens for introducing the ecology of the birds at a museum (mounted specimens), and those preserved for academic study (study skins) (Fig. 1). Study skins are prepared in a simple erect form so that the shape and dimensions are easy to measure, and the plumage color is easy to compare with other specimens. On the other hand, mounted specimens have a complicated structure to support the head, wings and legs with metal wire, wood wool (wood shaved into thread), silk floss and clay for preservation of the birds in various styles (Sakamoto 1931, Hashimoto 1977).

Most of the bird specimens (below, the “specimens”) of the RTCM collection that were damaged by the tsunami and salvaged were exhibition specimens. The specimens retrieved from the mud were washed to remove mud (primary washing; see Kumagai et al. (2013)), dried and transferred to the Yamashina Institute for Ornithology. Most specimens were severely damaged at the wings, legs and/or head. Mud and seawater penetrated from the damage to the inside of the specimen, contaminated the cotton and wood wool inside, and caused mold to develop. To repair the specimens, they need to be taken into pieces, and the stuffing had to be replaced. At the Institute, repair work on stuffed bird specimens was hitherto mainly exterior parts of birds such as gluing fallen feathers, repairing a broken leg and/or beak. We did not have experience of disassembling and reconstructing a specimen. Therefore, the repair work was carried out under the supervision of a taxidermist who had experience of repairing large bird specimens, Mr. Junji Ueno from Ueno Taxidermy Co., Ltd.

The repair of a stuffed bird specimen is described here in

あたり、大型剥製標本の修復を手がけたことのある、上野剥製所の上野純治剥製師の指導を受けながら進めました。

ここではイヌワシの展示用剥製の修復例から、鳥類標本の修復方法を紹介します。外部の泥や汚れを洗浄した鳥類の剥製(図2)は、一度乾燥させてから修復に向けた観察を行いました。イヌワシ剥製は被災によって、羽毛が抜け落ち、尾羽が尾椎ごと消失していました。破れた皮膚から剥製内部を確認したところ、皮膚の内側に黒いカビが発生し、芯となる鉄製の針金も錆びており、内部の洗浄と材料の交換が必要と判断されました。

#### <皮膚の軟化と解体>

剥製は、一度造られると乾燥した状態で保存されるため、皮膚は堅く乾き、形を変えると破損しやすい状態になります。この皮膚を軟化させて、解体するために、8から12時間ほど0.25%塩水に剥製を丸ごと漬けます。皮膚が軟らかくなったら、剥製の腹部にある縫い目をほどこき、体内に詰められた内容物(胴芯)を取り出します。翼、脚部、頭部などは針金で留められているため、針金を断ち切って、翼先端や脚部に差し込まれた針金を抜き取ります。筋肉の変わりに充填された綿もすべて除去します。皮膚が破れないよう注意しながら、骨と皮のみになるよう上記手順に従い、解体を行いました(図3)。このイヌワシ剥製は脛部と前腕部に筋肉が除去されていない部分があり、それらからカビが発生していたため、それら筋肉組織もすべて除去しました。頭部は針金で胴部と固定されており、その末端は頭頂部に差し込まれていました。そのため頭部の皮膚を裏

outline for a mounted specimen of a golden eagle (*Aquila chrysaetos*). The specimen, which was washed to remove mud and dirt from the surface (Fig. 2), was dried and checked to decide repair methods. Affected by the tsunami, some feathers had fallen and the specimen had lost its tail feathers together with the caudal vertebra. When the inside of the bird was observed from a tear on the skin, black mold was found to have developed on the interior surface of the skin. The steel wire serving as the core was also rusted. Thus the specimen was judged to require the interior to be washed, and the stuffing to be replaced.

#### Softening of the skin and dismantling

Once a stuffed specimen is made, it is preserved in a dry state. Therefore the skin becomes hard and dry, it is in a condition to be easy to get damaged when the form is changed. To let the skin soften and to dismantle it, the entire specimen was soaked in 0.25% salt water about 8 to 12 hours. Once skin softens, untie the seam in the abdomen of the stuffed specimens and take out contents (body core) filled the body with. As wings, legs and head are fastened with wire, and cut off the wire, then pull out the wire plugged into the wing tip and legs. Also cotton that has been filled in instead of muscle has to be removed. The specimen was dismantled carefully so as not to tear the skin following the above procedure. (Fig. 3). In this golden eagle specimen, there is a part that has not been removed in muscles of shins and forearms, and mold had occurred from them. Head was fixed to the body section with the wire, and the end was plugged into the top of the head. Thus, the skin at the head was turned over to remove the wire. Furthermore, the clay stuffing to substitute the muscles in the



図1 展示用剥製・本剥製（左、国立科学博物館所蔵）と学術標本・仮剥製（右下）  
 Fig. 1 Stuffed specimens (left: collection of National Museum of Nature and Science, Japan), and study skins (right)



図2 一次洗浄を終えた剥製（イヌワシ）  
 Fig. 2 Stuffed specimen (Golden Eagle *Aquila chrysaetos*) after the primary washing



図3 皮膚を軟化させた剥製の解体  
 Fig. 3 Disassembly of the specimen after softening the skin



返して針金を取り外しました。また、顎や頭部の筋肉の代わりに充填されていた粘土を除去し、ガラス製義眼も取り除きました。イヌワシ剥製は損傷が大きかったため、これ以上、皮膚の破損部を大きくしないため、また、後の洗浄作業をよりの確に進めるため、頭部と胴体部、尾部を切り離して作業を行いました(図4)。

#### <洗浄と防腐措置>

皮膚内側に発生した黒カビを歯ブラシやピンセットでこそぎ落とし除去しました。カビをすべて物理的に除去した後、カビ取り剤(次亜塩素酸ナトリウム・水酸化ナトリウム・界面活性剤を成分とするジョンソン社製カビキラー)を皮膚に噴霧し、殺菌およびカビの発生を抑える処置を施しました。皮膚の外側と羽毛部分を洗浄するために、家庭用液体洗剤(界面活性剤[アルキルエーテル硫酸エステルナトリウム、アルキルアミノオキシド、ポリオキシエチレンアルキルエーテル]、安定化剤、粘度調整剤、酵素を成分とするP&G社製台所用洗剤ジョイ)と洗濯用粉石鹼をぬるま湯に溶かし、羽毛と皮膚を丁寧に手で洗浄しました(図5)。洗浄を終えた皮膚と羽毛は水ですすぎ、洗剤をすべておとしてから、洗濯用脱水機を用いて脱水しました。

#### <乾燥と組み立て>

脱水した皮は羽毛を起毛させ、紐に吊るして広げ、扇風機の風をあてながら風乾させました。羽毛は一枚一枚を手でもみながら、細かい羽枝が絡み付かないようにして、羽毛のみを先に乾燥させ、皮は湿った状態のまま、補強と防腐のために、飽和明礬水と防腐剤(橋本1977、片岡1958を

参照)を内側に塗布しました。また、破れた部分はナイロン製の糸で縫い合わせました。胴芯は発泡ウレタンで新しく製作しなおし、ステンレス製針金と檜の棒を芯に用いました。剥製の再整形は基本的に、本剥製の組み立て手順に従いました(坂本1931、片岡1958)。翼は全腕骨から先端の部分の骨を残し、ステンレス製の針金を差し込み、それを芯として木毛を巻き付けました。足は脛骨から先を残して同じく針金を通し、木毛を巻いて肉付けを行いました。胴芯に貫通させた檜の棒を頭部に刺して固定し、その棒を頸椎の代わりとして脱脂綿と木毛で肉付けをしました(図6)。ウレタンの胴部に翼、脚部の針金の末端をそれぞれ各部位に固定します。翼は閉じるようにして胴体部に沿わせ、脚は腹部の上で交差させるように収めました。形が整ったら腹部をナイロン製の糸で縫い合わせ、抜けた羽毛も乾燥させ、皮膚の元の場所に合成接着剤(コニシ社製木工用ボンド)で張り合わせました。組み上げた剥製は羽毛の乾燥を確認し、脱脂綿で羽根が動かないように固定し、全体を1ヶ月ほどかけて乾燥させました。(注:本イヌワシは標本の損傷が激しく、展示用の剥製として修復するのは困難でした。そのため、学術標本の形で整形を行いました(図7))。

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jaw and head, and the glass eyes were removed. Because this eagle specimen was seriously damaged, the head, body and tail were separated so as not to spread the damage to the skin, and ensure that subsequent washing procedures could be properly executed (Fig. 4).

#### Washing and preservative treatment

The black mold being generated to the skin inside was scraped off with a toothbrush and tweezers. After having removed all the mold physically, mold removing agents (Johnson Co. Kabikira, sodium hypochlorite, sodium hydroxide, a surfactant component) were sprayed onto skin. Then, treatment to reduce the occurrence of sterilization and mold was applied. In order to clean the outside and feather part of the skin, dishwashing liquid detergent (Surfactant [Sodium alkyl ether sulfate ester, Alkyl amine oxides, Polyoxyethylene alkyl ether], Stabilizers, Viscosity modifiers, P & G Co., Ltd. kitchen detergent Joy including enzyme components) and laundry powder soap were dissolved in lukewarm water. Then the feathers and skin were washed carefully by hand (Fig. 5). After skin and feathers that have finished the cleaning were rinsed with water, and washing off all the detergents then dehydrated using a laundry dehydrator.

#### Drying and assembly

After dehydrated skin, the feathers were brushed, and air dried with the wind of the fan. While grooming feathers one by one with hand, be careful as fine feather branch is not entangled, only feather is dried ahead, and skin remains moist. For reinforcement and preservatives, saturated potassium alum ( $\text{AlK}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ ) water and preservative (Hashimoto 1977

and Kataoka 1958) was applied on the inside of the skin. In addition, the torn part was stitched with nylon thread. Body core is newly made in urethane foam, and stainless steel wire and wooden applicator were used as the core and support. As for reshaping of specimens basically, we follow the assembly procedure of mounted specimens. (Sakamoto 1931 and Kataoka 1958). In the wings, leaving the bone part of the tip from humerus, insert the stainless wire was wrapped around a wood wool as a core. The tibiotarsus and tarsometatarsus were similarly preserved, reinforced with wire, and wrapped with wood wool to give the form. A sharpened wood applicator that penetrated through the body core was inserted into the head, and fixed as a substitute for the cervical vertebrae. Cotton and wood wool were wrapped around the stick to give form (Fig. 6). Each wire end of wing and leg were fixed to the body portion of the urethane. Wings were along the body so as to close, legs were achieved so as to cross over the abdomen. Once the form is well-equipped, then stitched the abdomen with a thread made of nylon. Fallen feathers were also dried and glued to the original point on the skin with a synthetic adhesive (wood glue, product of Konishi Co., Ltd). The repaired specimen was fixed with absorbent cotton after the feathers were completely dry, and dried the whole for approximately one month. (Note: This specimen of Golden Eagle was so severely damaged that it was difficult to repair as a stuffed specimen. Therefore, it was formed into a study skin (Fig. 7).)

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図4 解体された剥製  
Fig. 4 Disassembled specimen



図5 剥製の洗浄作業  
Fig. 5 Washing of the specimen



図6 新しく作成された胴芯（ウレタン製）を用いた剥製の再構築  
Fig. 6 Reconstruction of the specimen using a new (urethane) body core



図7 仮剥製として修復されたイヌワシ標本  
Fig. 7 Specimen of Golden Eagle *Aquila chrysaetos* restored as study skins