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Radiographic analysis of Meinertzhagen's redpoll specimens: testing a purported case of fraud

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Summary.—Based on a detailed analysis of the external appearance of redpoll *Acanthis* skins, Knox (1993) explicitly accused the collector Richard Meinertzhagen of having stolen specimens from the Natural History Museum bird skin collection and re-labelling them. Here, I test Knox's results using independent evidence of the internal appearance of the specimens in question derived from radiography. Radiographic evidence strongly supported Knox's overall conclusion of fraud by Meinertzhagen but revealed limitations inherent in his attempt to determine the collection history of bird skins using external appearance alone. Although results in such investigations are inherently likely to be probabilistic rather than certain, a multi-factorial approach, taking a wide array of evidence into account, is most likely to engender confidence in the outcome.

The publication of Knox (1993) comprised the first focused investigation of long-standing anecdotal evidence that the ornithologist Richard Meinertzhagen had fraudulently acquired and relabelled at least part of his huge bird skin collection. In 1954, Meinertzhagen presented the entire bird skin collection he still retained, nearly 20,000 specimens, to the then British Museum (Natural History), now Natural History Museum (NHMUK), following a close, but often acrimonious, relationship with the institution spanning *c.*40 years. Following its handover, he continued to work on his collection in the museum in South Kensington, London, until prevented from doing so by increasing frailty in the years preceding his death in 1967. In the early 1970s, the entire NHMUK bird research collections, including the Meinertzhagen skins, were moved from London to the museum's site in Tring, where they continue to be held.

The possibility of fraud in Meinertzhagen's bird skin collection had first been alluded to in print by Clancey (1984), in an article providing an overview of the NHMUK bird collections at Tring, but by this time it had already been the subject of discussion and investigation over many years by staff and ornithological associates of NHMUK (*cf.* Cocker 1989, Rasmussen & Prŷs-Jones 2003, Garfield 2007, Prŷs-Jones *et al*. 2019). Knox's (1993) investigation involved close external examination of Meinertzhagen's redpoll (*Carduelis* spp., now *Acanthis* sp.—see below) skins, and comparisons of these with other redpoll specimens held by the NHMUK, as a by-product of research into the taxonomy of the group (Knox 1988). His conclusions, based on a combination of subjective and objective assessment of skin preparation styles, provided compelling, but not definitive, evidence that Meinertzhagen had committed fraud.

Two questions in particular arise from the research and allegations of Knox (1993). The first concerns whether it is possible to produce independent evidence that will substantiate or refute allegations based on external preparation style alone concerning the genuine or fraudulent status of Meinertzhagen's specimens. The second relates to whether any fraud committed pertains to specific and limited parts of Meinertzhagen's bird collection or affects

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it more generally. Here, I address the first of these issues by using radiographic techniques to reveal the internal structure of the redpoll skin specimens studied by Knox (1993).

Redpoll taxonomy has moved on since Knox (1993) was published. First, it is now generally accepted that redpolls comprise a separate genus, *Acanthis* (Zuccon *et al*. 2012). Secondly, recent genetic studies indicate that all redpolls may be best viewed as comprising a single species *A. flammea*, despite the extent of phenotypic variation among them (Lifjeld 2015, Mason & Taylor 2015, Funk *et al.* 2021). For my purposes here, this change is less important than facilitating an easy comparison with Knox's (1993) study. When necessary, specimens discussed below are therefore designated in inverted commas by the subspecific names (*flammea*, *cabaret*, *rostrata*, *hornemanni*, *exilipes*) then in use to designate phenotypic distinctiveness.

Methods

The redpoll specimens x-rayed for this study included all those referenced by their NHMUK registration numbers in Knox (1993). They comprised 22 skins from the Meinertzhagen collection and 19 from other NHMUK collections from which Knox suspected that Meinertzhagen might have stolen specimens that he then relabelled as his own. I undertook the radiography on the NHMUK Solus-Schall x-ray machine, with a beryllium window tube at 1 m and using Kodak Industrex-M film, at 30 kV and 10 mA for an exposure time averaging 35 seconds.

Some of the x-rayed redpoll specimens produced largely opaque images in which details of bone structure were obscured to a greater or lesser extent. This was presumed to be caused by these skins having been treated with arsenic, formerly employed as a preservative during preparation by some collectors (Harrison & Cowles 1970). Arsenic, especially mixed with chalk as in arsenical soap, would be expected to absorb x-rays, causing opacity (M. Moore & P. Morris *in litt*. 1996). To test for this, I removed samples of a few mg of skin from just inside the belly incision of eight of the x-rayed redpoll specimens, chosen to include birds producing both relatively clear and largely opaque images and to encompass a diversity of putative origins. Three of these specimens were subsequently re-sampled by removing a small amount of stuffing material from an orbit of each. These samples were submitted blind to the Chemistry Dept. of Royal Holloway, Univ. of London, to test for the presence of arsenic by mass-spectrometry.

A full list of the NHMUK registration numbers of all specimens x-rayed and sampled for arsenic is provided in Table 1, together with dates of collection, sex, collection localities and collectors, as recorded on their labels, plus a cross-reference to the specimen identification codes used in the text and on the radiographic images figured herein. Finally, minor errors made by Knox (1993) in his specimen referencing are corrected.

Results

Radiographic evidence.—Subheadings used below follow those in Knox (1993) for ease of comparison.

1. Blois, France, 1953. On Fig. 1, specimens A–C are the three Meinertzhagen skins, phenotypically '*cabaret*', labelled as having been collected in Blois, France, on 17 January 1953, by 'G.B.' (identity unclear) and then 'sent formalined' to Meinertzhagen. Specimens D–J are the seven extant skins, also '*cabaret*', from a series of 13 originally registered in NHMUK, taken by R. B. Sharpe at Hanwell, Middlesex, England, on 17 November 1884. The radiographic images, however, indicate an identity of preparation style for each of specimens B–J inclusive, with A being unequivocally distinct. Points of similarity for B–J,

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TABLE 1

All specimens mentioned in the paper are listed below, cross-referenced to their code used in the text and figures (NB – BB, JJ and MM were not used). Information on collection date (no year of collection is available for the Lenz specimens), sex (M = male, F = female), locality and collector is that shown on the relevant specimen labels. Specimens A–T are phenotypically species *flammea* and U–RR species *hornemanni* according to the taxonomy used by Knox (1993). Meinertzhagen specimens sampled for arsenic have an asterisk (*) against their code.

Code	NHMUK reg. no.	Collection date	Sex	Locality	Collector
A*	1965.M.17376	17 Jan 1953	M	Blois, France	'G.B.' for R. Meinertzhagen
B	1965.M.17377	17 Jan 1953	M	Blois, France	'G.B.' for R. Meinertzhagen
C*	1965.M.17378	17 Jan 1953	F	Blois, France	'G.B.' for R. Meinertzhagen
D	1886.10.20.39	17 Nov 1884	M	Hanwell, England	R. B. Sharpe
E	1886.10.20.40	17 Nov 1884	M	Hanwell, England	R. B. Sharpe
F	1886.10.20.41	17 Nov 1884	M	Hanwell, England	R. B. Sharpe
G*	1886.10.20.42	17 Nov 1884	M	Hanwell, England	R. B. Sharpe
H*	1886.10.20.45	17 Nov 1884	F	Hanwell, England	R. B. Sharpe
I	1886.10.20.46	17 Nov 1884	F	Hanwell, England	R. B. Sharpe
J	1886.10.20.49	17 Nov 1884	F	Hanwell, England	R. B. Sharpe
K	1965.M.17330	7 Dec 1932	M	Asknish, Scotland	R. Meinertzhagen
L*	1965.M.17331	7 Dec 1932	M	Asknish, Scotland	R. Meinertzhagen
M*	1965.M.17332	4 Dec 1932	M	Asknish, Scotland	R. Meinertzhagen
N	1965.M.17333	7 Dec 1932	M	Asknish, Scotland	R. Meinertzhagen
O*	1965.M.17335	7 Dec 1932	M	Asknish, Scotland	R. Meinertzhagen
P*	1965.M.17357	5 Dec 1932	F	Asknish, Scotland	R. Meinertzhagen
Q	1965.M.17352	30 Aug 1955	M	North Atlantic (60°N, 14°W)	R. Meinertzhagen
R	1965.M.17347	22 Nov 1920	M	Taynish, Scotland	R. Meinertzhagen
S	1965.M.17343	17 Nov 1920	M	South Uist, Scotland	R. Meinertzhagen
T	1965.M.17348	21 Oct 1920	M	Taynish, Scotland	R. Meinertzhagen
U	1965.M.17379	21 Oct 1920	M	Mull, Scotland	R. Meinertzhagen
V	1965.M.17396	30 Aug 1955	M	North Atlantic (60°N, 14°W)	R. Meinertzhagen
W	1937.10.17.309	28 May 1937	M	Moskusokse Fjord, Greenland	C. G. & E. G. Bird
X	1937.10.17.310	12 Oct 1936	M	Myggbukta, Greenland	C. G. & E. G. Bird
Y	1937.10.17.312	4 Nov 1936	M	Myggbukta, Greenland	C. G. & E. G. Bird
Z	1937.10.17.313	4 Nov 1936	M	Myggbukta, Greenland	C. G. & E. G. Bird
AA	1937.10.17.314	4 Nov 1936	M	Myggbukta, Greenland	C. G. & E. G. Bird
CC	1937.10.17.315	9 Nov 1936	M	Myggbukta, Greenland	C. G. & E. G. Bird
DD	1937.10.17.316	21 May 1937	M	Myggbukta, Greenland	C. G. & E. G. Bird
EE	1937.10.17.317	1 Oct 1936	F	Mackenzie Bay, Greenland	C. G. & E. G. Bird
FF	1937.10.17.318	16 Oct 1936	F	Myggbukta, Greenland	C. G. & E. G. Bird
GG	1965.M.17387	6 Mar 1938	?	Inari, Lapland, Finland	R. Meinertzhagen
HH	1965.M.17386	6 Mar 1938	F	Inari, Lapland, Finland	R. Meinertzhagen
II	1965.M.17384	6 Mar 1938	M	Inari, Lapland, Finland	R. Meinertzhagen
KK	1965.M.17383	24 Feb 1938	F	Rovaniemi, Lapland, Finland	R. Meinertzhagen
LL	1965.M.17314	7 Mar 1938	F	Inari, Lapland, Finland	R. Meinertzhagen
NN	1965.M.17385	7 Mar 1938	M	Inari, Lapland, Finland	R. Meinertzhagen
OO	1886.3.31.16	1 Feb	F	Moscow, Russia	Dr Lenz
PP	1886.4.3.15	17 Feb	M	Moscow, Russia	Dr Lenz
QQ	1884.9.25.19	1 Mar	M	Moscow, Russia	Dr Lenz
RR	1965.M.17382	24 Feb 1938	?F	Rovaniemi, Lapland, Finland	R. Meinertzhagen

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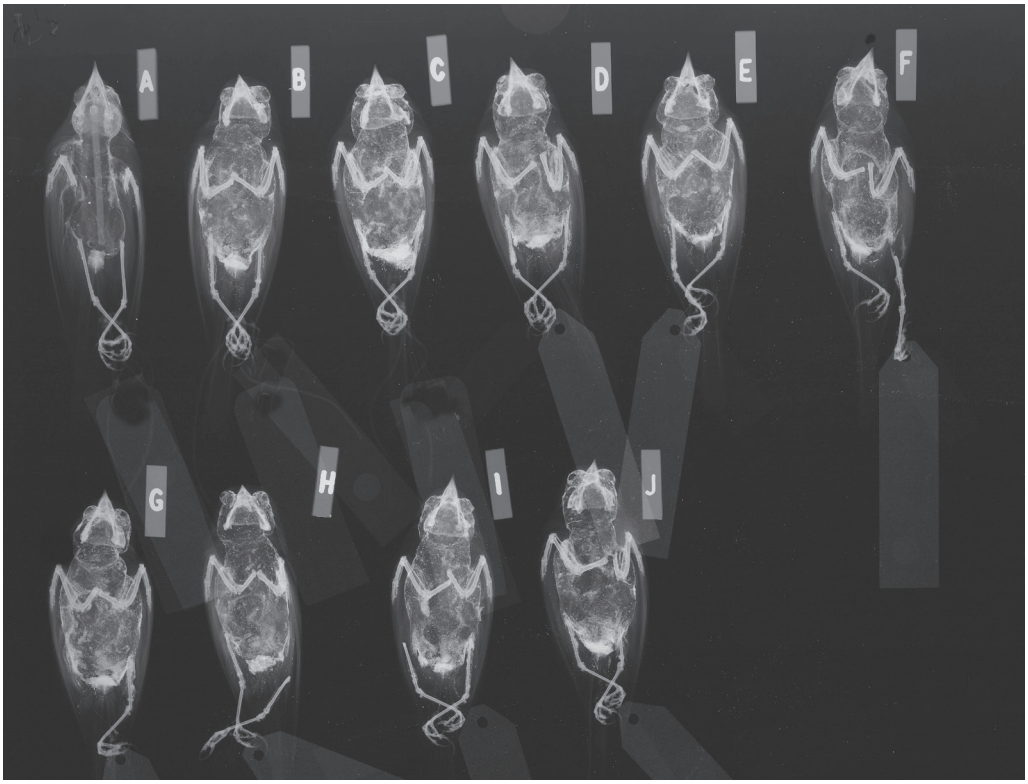

Figure 1. Radiographs of Meinertzhagen redpoll *Acanthis* skins from Blois, France (A–C) and of Sharpe redpoll skins from Hanwell, England (D–J). Full details of each specimen can be found in Table 1.

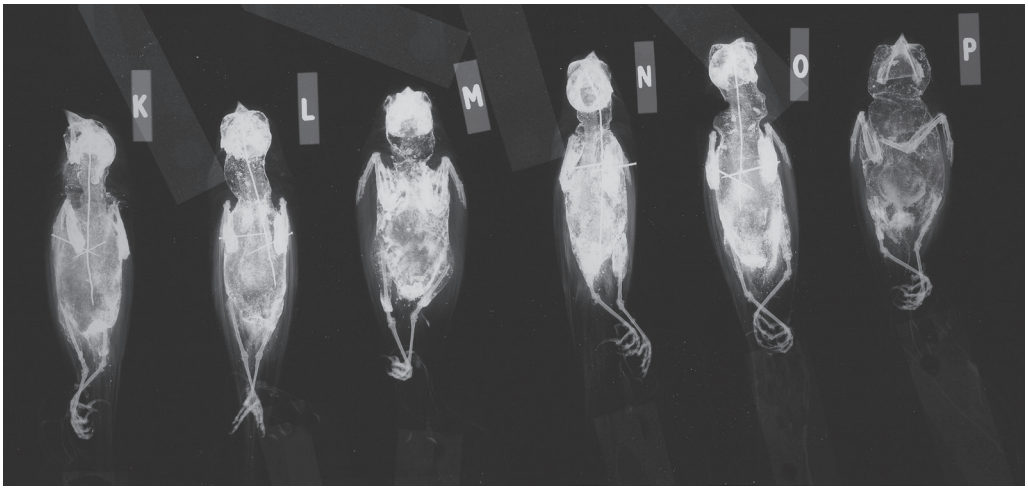

Figure 2. Radiographs of Meinertzhagen redpoll *Acanthis* skins from Asknish, Scotland. Full details of each specimen can be found in Table 1.

but of difference to A, include the unusual cut-away rear skull, severance of the wing bones through the humerus, absence of a support stick, and overall extent and pattern of lighter and darker areas on the images. These results corroborate the conclusions of Knox (1993), based on external skin preparation style, who identified specimens B and C as closely

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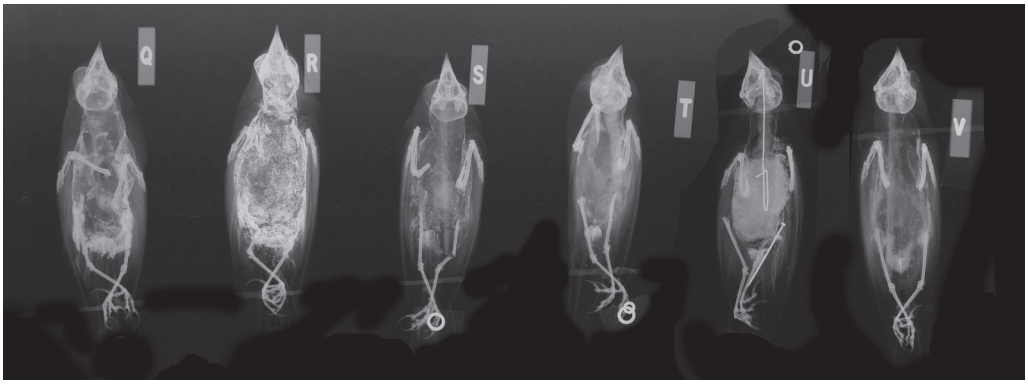

Figure 3. Radiographs of Meinertzhagen *Acanthis* redpoll skins from the North Atlantic (Q and V) and Scotland (R–U). Full details of each specimen can be found in Table 1.

matching Sharpe's Hanwell series, but specimen A as clearly different. Moreover, there is no indication that any of A–C has ever been in formalin, which has the attributes of making the skin rubbery, so that it does not shrink back and the feathers tend not to lie flat, and the specimen difficult to prepare.

2. Asknish, Argyll, 1932. On Fig. 2, specimens K–P are the six redpolls labelled by Meinertzhagen as having been collected by himself at Asknish, Argyll, Scotland, between 4 and 7 December 1932. Specimens K, L, N and O, which are all phenotypically '*flammea*', are each highly opaque and show close similarity to each other in visible internal preparation style, including a thin longitudinal wire support and pinned wings. Specimen M, also '*flammea*', is also highly opaque but otherwise shows differences from the foregoing, most notably in lacking either an internal support wire or pinned wings. Specimen P, a '*cabaret*', is totally distinct in preparation style from the other Argyll specimens, but identical to Sharpe's Hanwell series (D–J, Fig. 1). These results precisely corroborate the conclusions of Knox (1993) based on external appearance.

3. North Atlantic, 60°N, 14°W, 1955, and 4. West coast of Mull, Scotland, 1920. On Fig. 3, specimens Q and V are respectively '*rostrata*' and '*hornemanni*', both labelled by Meinertzhagen as having flown on board a ship in the North Atlantic on which he was travelling on 30 August 1955. The radiographic evidence supports Knox's (1993) conclusion, based on external features, that these are different styles of skin; thus Q has a more hollowed-out skull, lacks a supporting stick and has an image showing greater opacity around the tail base and tibial regions.

By contrast, the radiographic images refute Knox's (1993) opinion from external evidence that specimen V closely matches another Meinertzhagen specimen, U, which is labelled as a ?*exilipes* collected on the island of Mull in 1920 (Fig. 3). U appears to be a re-made skin, in which a wedge of stuffing fills the body cavity but does not reach the neck, and a supporting wire extends from the front of the skull into the mid-body cavity. The radiographic images do, however, tend to confirm Knox's (1993) further opinion that U differs in preparation style from two other '*flammea*' (R and S), purportedly collected by Meinertzhagen in Scotland in 1920. In fact, these three skins, R, S and U, plus a fourth, T, with similar data but which Knox was unable to locate, are strikingly heterogenous in preparation style (Fig. 3).

Comparisons of the radiographs of U and V with those shown in Fig. 4 of specimens of '*hornemanni*' taken in Greenland in 1936 (X–Z and AA, CC, EE and FF) and 1937 (W and DD) by the brothers C. G. & E. G. Bird reveals V, but not U, to be very similar, in particular

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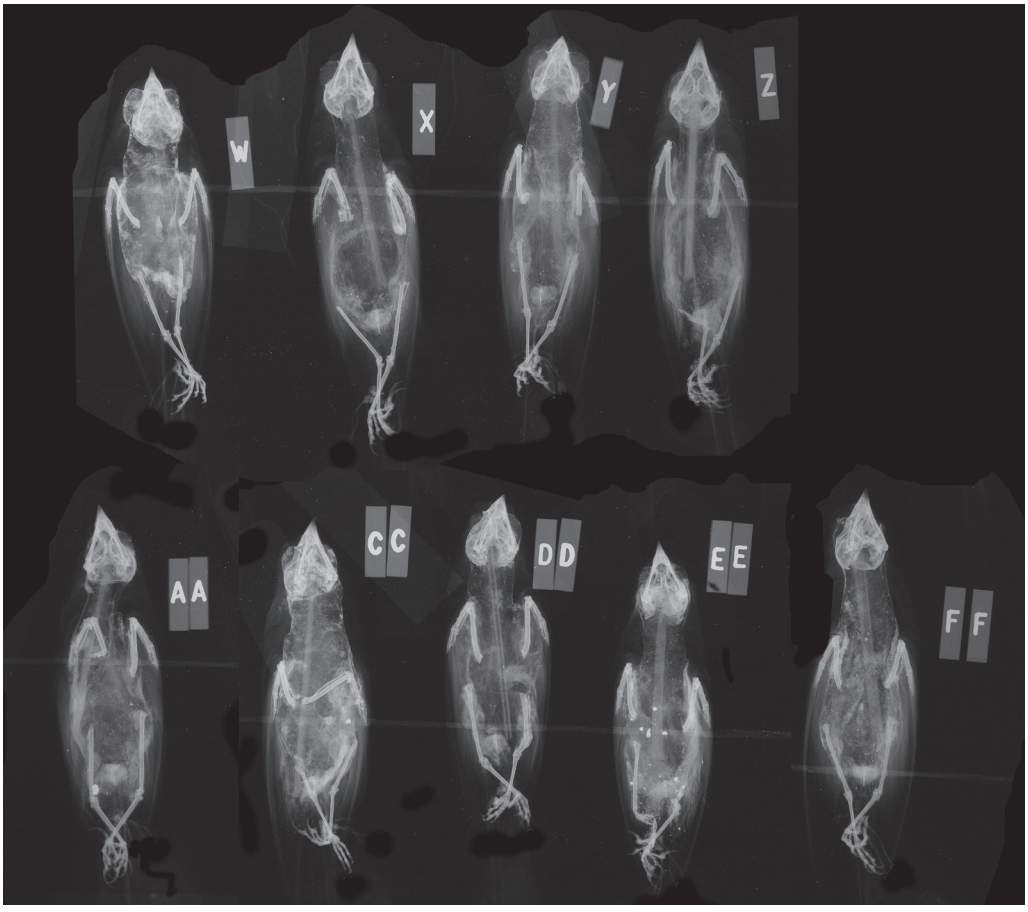

Figure 4. Radiographs of C.G. & E.G. Bird redpoll *Acanthis* skins from Greenland. Full details of each specimen can be found in Table 1.

to their 1936 specimen preparation style. Although Knox (1993) recorded two specimens as missing from the Bird brothers' 1936 series, there is now only a single redpoll skin from the entire NHMUK Bird brothers' Greenland series that cannot be accounted for. This is the October 1936 male registered as 1937.10.17.311 (listed in error by Knox as 1937.10.17.11), which Knox correctly deduced from plumage features must be specimen V. Contrary to Knox (1993), however, specimen U is almost definitely not a Bird brothers' skin.

5. Finland, 1938. Knox (1993) examined 21 redpoll skins, almost all '*exilipes*' purportedly collected by Meinertzhagen in northern Finland in February/March 1938, and found that they fell into three groups based on external make-up. In Fig. 5, GG–II are three of the 17 specimens that Knox suggested from external appearance might be Meinertzhagen's own style of preparation, whereas KK, LL and NN are in a different style that Knox claimed closely matched a Moscow series obtained by NHMUK in the 1880s from the London dealer P. A. Holst and collected by a Dr Lenz (Sharpe 1888, 1906); according to Knox, the single representative of the third style is RR.

The radiographs concur with these conclusions by revealing pronounced differences in internal appearance between the three groups, but consistency within each of the two groups comprising more than one specimen. Furthermore, KK, LL and NN show very similar radiograph images to OO–QQ, which are all from the Moscow series; the intact

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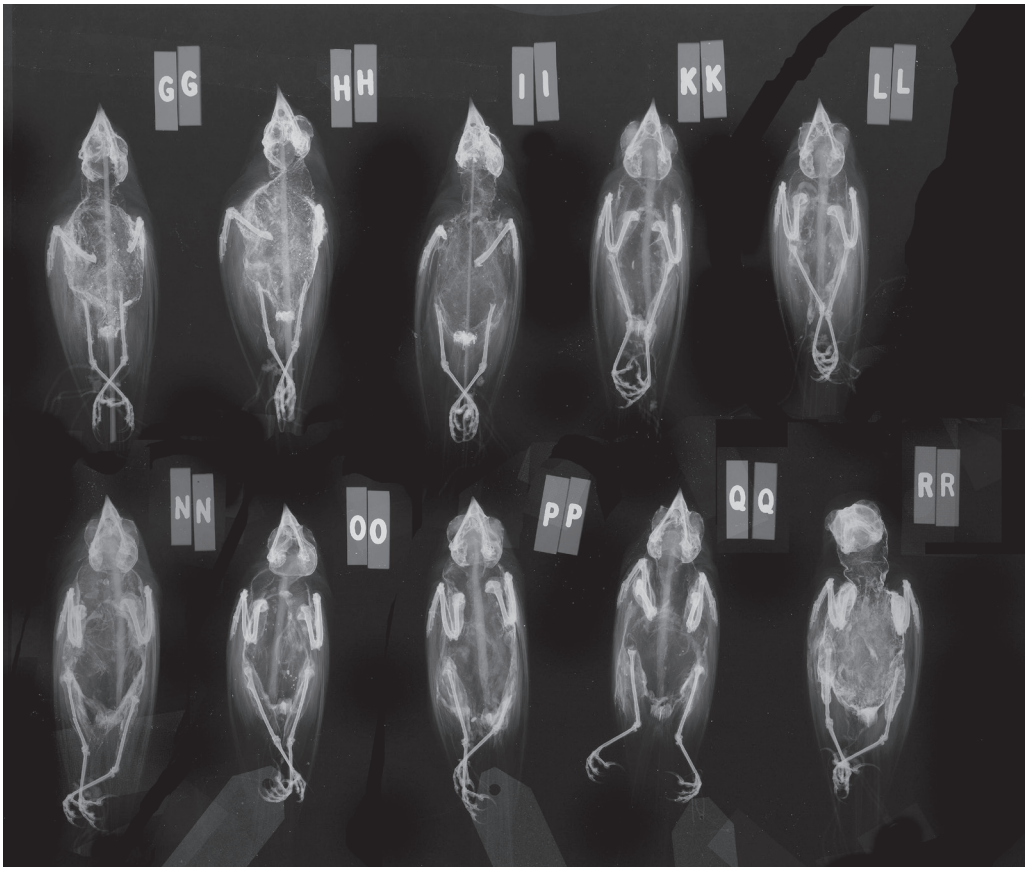

Figure 5. Radiographs of Meinertzhagen redpoll *Acanthis* skins from Finland (GG–NN and RR) and Lenz redpoll skins from Moscow, Russia (OO–QQ). Full details of each specimen can be found in Table 1.

humeri, carefully disarticulated from the pectoral girdle elements, are particularly striking in this regard. Although only two of Holst's Lenz redpolls registered into the NHMUK collection are now unaccounted for, a third might easily have been unregistered or acquired by Meinertzhagen from another collection (*cf*. Knox 1993).

Evidence of arsenic.—Samples of skin for arsenic analysis were removed from eight specimens: two of Meinertzhagen's Blois birds, one of which (C) closely matched the Hanwell series on both external and radiographic evidence, whereas the other (A) did not (Fig. 1); two Hanwell specimens (G and H) (Fig. 1); and four of Meinertzhagen's Scottish birds, three of which (L, M and O), comprising two different preparation styles, were highly x-ray opaque, whereas the fourth (P), identical in style to the Hanwell series, was not (Fig. 2). The results of testing unambiguously divided the specimens into two distinct groups. Five (A, C, G, H and P) contain no detectable arsenic, whereas the other three (L, M and O) each contain high levels of the element.

The three specimens re-analysed using stuffing recovered from their orbits included the two Hanwell birds, G and H, which again showed no evidence of arsenic above background levels despite having their stuffing visibly contaminated with an unidentified powder, presumably used during their preparation. The third was a Meinertzhagen Scottish specimen, O, for which the analysis again revealed the presence of substantial arsenic despite lacking visible preservative on its stuffing.

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Discussion

Taken as a whole, the results presented above amply confirm the main thrust of Knox's (1993) argument. There is very strong evidence from specimen preparation style (internal and external), in combination with current gaps in series of birds that were entered into the NHMUK registers, that Richard Meinertzhagen stole skins from the NHMUK and relabelled them with data that made it appear that he had collected them. This finding therefore confirms the informal and private conclusions of some influential ornithologists of an earlier generation who had studied specimen material from both the NHMUK's and Meinertzhagen's skin collections. As an example, around 1939/1940 Claud Ticehurst wrote to Hugh Whistler explicitly accusing Meinertzhagen of having stolen NHMUK skins of various Himalayan finch species he was studying, concluding 'But what a fool Dick [= Richard Meinertzhagen] is! Does he think for a moment that I am hoodwinked over these skins? Almost every skinner indelibly stamps his name on every skin he makes.' (NHMUK Archives).

Nevertheless, the present study also reveals some limitations as to what can be deduced from external examination of skins alone, highlighting that the above statement by Ticehurst on skin make-up style should be taken as no more than a generality. Skins that appear very similar externally can at times show much more obvious differences when their internal preparation style is investigated, as demonstrated by the way that Knox (1993) was misled into believing that specimen U (Fig. 3) could be from the Bird brothers' Greenland series (Fig. 4). The question of potential variability in the preparation style of individuals (including Meinertzhagen) over time, especially in an era when collectors frequently had assistants working with them who were not always acknowledged, also must be borne in mind.

Despite the above, it should be emphasised that the degree of variability exhibited in skin make-up style in specimens supposedly collected by Meinertzhagen himself at particular times and places is striking. Six redpoll skins (K–P, Fig. 2), supposedly taken by him over four days in 1920, are prepared in three different styles; of the three tested for arsenic, two involved its use as a preservative whereas one did not. Arsenic use appears to have been a characteristic of particular collectors; thus, for example, various Russian collectors such as Nikolai Przhevalsky made skins that are almost invariably highly opaque when x-rayed, and ornithologists such as Robert Tytler and Elliott Coues were so keen on using powdered arsenic that they may have suffered early deaths from its side effects (Prŷs-Jones *et al*. 2021). The limited evidence adduced in the current study suggests that skins are largely opaque due to arsenic use in their preparation, but that more limited opaque flecking, e.g. as exhibited by the Hanwell skins (D–J, Fig. 1), can have other causes.

A further complication that may intrude into interpretations of skin specimen preparation style is re-making, whereby a prepared skin is relaxed and then re-prepared. This tends to obscure, although not usually completely, both the external and internal handiwork of the original preparator, as described by Rasmussen & Collar (1999) and Kennerley & Prŷs-Jones (2006) in their respective analyses of the true origins of two fraudulent rarities in Meinertzhagen's collection, namely a Forest Owlet *Athene blewitti* and the supposed second European record of Gray's Grasshopper Warbler *Helopsaltes fasciolatus*. Re-making is unusual, however, and of the specimens discussed in this paper only U showed evidence of it, as described above.

Finally, it should be emphasised that the process of trying to restore original data to Meinertzhagen specimens that evidence indicates have been stolen and relabelled is fraught with difficulty and almost always must be treated probabilistically. The NHMUK bird skin

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collection is enormous, approaching three-quarters of a million specimens, and in reconciling register entries with numbers of specimens currently present it is almost inevitable that inconsistencies will occur, as exemplified by the two specimens mentioned in the Results section that Knox (1993) was unable to locate. Even when specimens are seemingly unaccountably missing, there may be reasons other than theft for their apparent absence that require investigation (Knox & Walters 1992). Moreover, although Meinertzhagen spent most time working in NHMUK, he also visited many other museums, in particular the bird collection of Walter Rothschild, formerly at Tring but since the early 1930s largely held by the American Museum of Natural History, New York. The description of the activities of the ornithologist 'Dr. Cyril Cunningham', whom Miriam Rothschild (1983) recorded as stealing specimens from Walter Rothschild's collection and discarding their labels, in fact relates to Richard Meinertzhagen, although she did not wish this to become public knowledge during her lifetime (Prŷs-Jones *et al*. 2019). There is also strong evidence that Meinertzhagen removed specimens from other museums, including St Peterburg and Paris (C. Vaurie *in* Cocker 1989: 274) as well as Stockholm (C. Edelstam pers. comm.).

In conclusion, radiography has proved to be a valuable tool for confirming, and occasionally correcting, information derived from external skin appearance in documenting specimen fraud that Richard Meinertzhagen clearly committed during his ornithological career. A further paper will examine the apparent scope of such fraud with reference to Meinertzhagen's Asian bird collection.

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