BSCE 20 / WP 35
Helsinki 1990

The Convair accident in the Skagerak 1989 - A presentation of the identification work on feather remains found in the wreckage.

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SUMMARY

A Norwegian registered Convair aircraft crashed into the sea north of Denmark in 1989. Fifty-five people were killed. This paper describes the results of the chemical tests and the identification work which were carried out on the feather remains found in the wreckage. The findings do not support the theory that a bird strike caused the accident.

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INTRODUCTION

A chartered Convair aircraft LN-PAA, owned by the Norwegian company Partnair, crashed in the Skagerak on 8 September 1989 at 4.37 pm. This twin-engined propeller aircraft was cruising at 22 000 feet on its route from Oslo to Hamburg, when it suddenly lost height and crashed into the sea. In all, 55 people were killed.

The aircraft, which disintegrated, was localized on the sea-bed 5 nautical miles north of Skagen on the northernmost point of Jutland, Denmark (in Tannis Bay). The parts of the wreckage, which were found on a soft mud bottom at a depth of about 90 m, were spread over more than 50 km^2. More than 500 parts have been found and more parts are still being retrieved in nets by fishermen. The remains have been transported to Oslo, where the Aviation Accident Investigation Board has its headquarters. Of the 55 people that were killed in the accident, four have still not been found.

MATERIAL AND METHODS

When the parts of the aircraft were examined in detail by the Investigation Board, bird remains were found. One feather was stuck to the deformed altitude decoder and another was found on the internal framework of the cargo door. The altitude decoder with the feather and the feather from the cargo door were examined by the Aviation Bird Office at the Zoological Museum and by the Institute of Forensic Medicine, both at the University of Oslo. Light-microscopical comparison with reference material and chemical tests of the feather surfaces were carried out. The two feathers, which are shown in Fig. 1, were later sent to the Institute of Taxonomic Zoology at the University of Amsterdam for further examination. This examination consisted of light-microscopical (LM) and scanning-electron-microscopical (SEM) studies of the feathers and a direct comparison with feather material in the bird skin collection of the Zoological Museum in Amsterdam.

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RESULTS

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Figure 1. The two feathers found in the wreckage. *Left:* The feather from the cargo door. *Right:* The feather found in the altitude decoder.

RESULTS

Chemical tests of the feathers and the altitude decoder

Chemical tests were carried out in order to find blood or bloodstained material on the surface of the feathers or on the altitude decoder.

- Feather no. 1 (the feather on the altitude decoder) was tested with a benzidin reagent. The reaction was negative, i.e. no traces of blood were found on the feather.
- The altitude decoder was also tested with the benzidin reagent. No certain positive reaction was observed, i.e. some of the tested areas on the decoder gave a very weak and slow, bluish-coloured response, which could not be recorded as an unambiguous positive reaction.
- The benzidin test was carried out on feather no. 2 (the feather from the cargo door). This test gave a delayed, atypical colour-reaction. In addition, the outermost part of the feather was exposed to Ouchterlony´s test for anti-human serum. This test gave a negative reaction.

Conclusion of the chemical tests: No blood or bloodstained material was found on the feathers or on the altitude decoder. This indicates that the feathers might have been shed by the bird(s) in connection with active moult rather than by violent impact.

Identification of the feathers

Feather no. 1 was a white body-feather with a greyish base. The feather, which was not glossy, was complete, including an afterfeather, and its total length was 44 mm. The shaft was broad at the base and curved ventrally, and it was most likely a breast-feather. The afterfeather, which was without shaft, closely resembled type "e" of Ziswiler (1962). This type is found in the families Podicipedidae (grebes), Ardeidae (herons and bitterns), Rallidae (rails, crakes and coots), Haematopodidae (oystercatchers), Charadriidae (plovers and lapwings), Laridae (gulls) and Alcidae (auks).

The microscopic study of feather no. 1 gave the following results:
Pennaceous part: Flexules were present on the pennaceous barbules (Fig. 2) at the tips of the barbs (thus in the open pennaceous area) and graded into barbicels on the pennulum; denticules were absent, ungules present.

Figure 2. Feather no. 1: Flexules on barbules from a pennaceous barb in the tip third of feather (SEM, 760x).

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Figure 3. Feather
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According to Brom & Visser (1989) this leads to one of the following families: Diomedeidae (albatrosses), Procellariidae (fulmars, petrels and shearwaters), Hydrobatidae (storm-petrels), Pelecanoididae (diving petrels), Pelecanidae (pelicans), Sulidae (gannets), Phoenicopteridae (flamingoes), Gruidae (cranes), Rallidae, Haematopodidae, Charadriidae, Scolopacidae (sandpipers and allies), Recurvirostridae (stilts and avocets), Stercorariidae (skuas), Laridae and Alcidae.

Downy part: Downy barbules were short (total length< 3 mm) and lacked distinct or pigmented nodes. Their bases were without villi; prongs were placed on the pennulum in groups of 2 or 4, were shorter than internodes and confined to distal halves of barbules (Figs. 3 & 4). According to Brom (1986) this limits the number of families to which the bird could have belonged to: Gaviidae (divers), Podicipedidae and Alcidae.

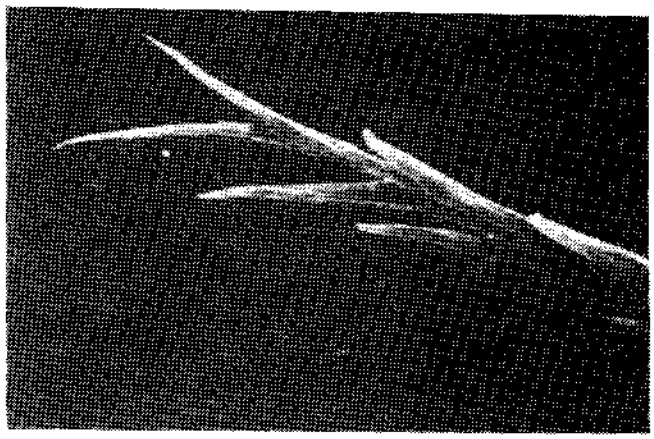

Figure 3. Feather no. 1: Tip of basal barbule from a downy barb of the feather (SEM, 2060x).

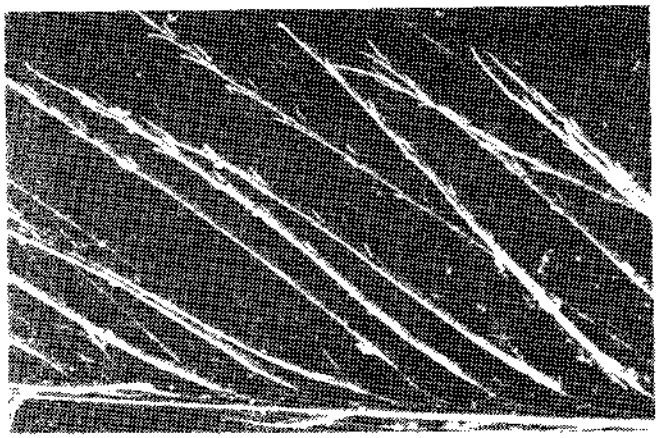

Figure 4. Feather no. 1: Prongs at the tips of barbules mid on a barb of the afterfeather (SEM, 770x)

The diagnosis of the identification according to what has been mentioned above strongly indicates that feather no. 1 originates from one of the alcids, as only in this family (Alcidae) such a combination of these three characteristics is found.

Feather no. 2 was a dirty-white, non-glossy feather. It had no afterfeather and was most likely an under wing-covert. It was complete and its length was 99 mm. The shaft was curved laterally (left). Feathers of this type are only found in Sulidae, Anatidae (swans, geese and ducks), Haematopodidae and Laridae.

Pennaceous part: The distal barbules had large and curved hamuli (Fig. 5). The pennula were rather short. No flexules, denticules or ungules were present. The feather structure was most similar to that found in the gull family (Laridae).

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Figure 6. Feathe
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Figure 5. Feather no. 2: Large and curved hamuli on the distal barbules from the basal part of a pennaceous barb (SEM, 760x).

Downy part: The bases of downy barbs were of a pennaceous structure. Sparse downy barbules were found with weakly developed four-lobed nodes proximally (Figs. 6 & 7). The bases were without villi. The structures observed point towards the family Laridae.

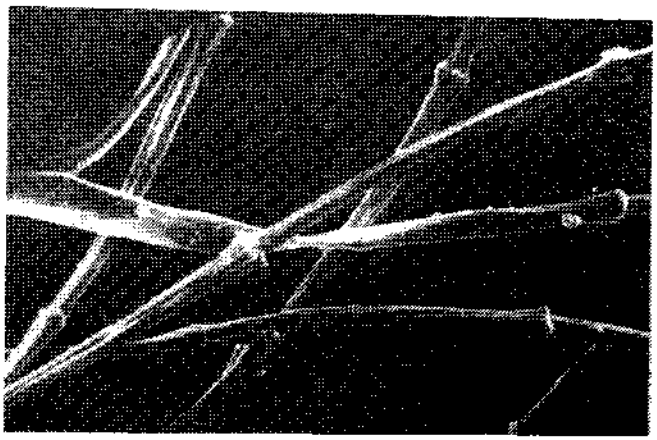

Figure 6. Feather no. 2: Weakly developed four-lobed nodes proximally on the downy barbules mid on a basal barb (SEM, 1020x).

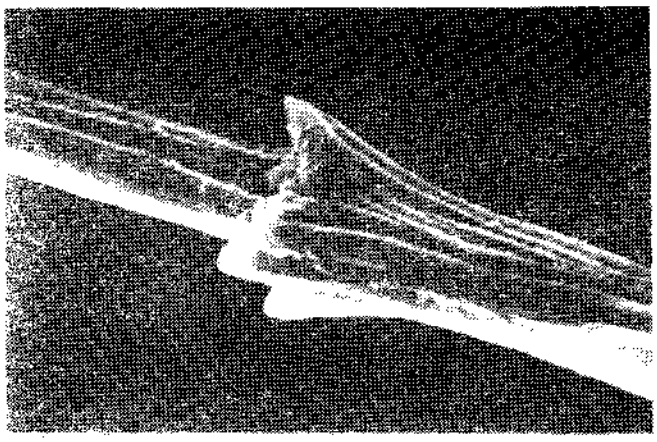

Figure 7. Feather no. 2: Four-lobed node in the basal third of a downy barbule mid on a basal barb (SEM, 5040x).

The diagnosis of feather no. 2 is: Laridae. On the basis of comparison with reference material in bird skin collections it appeared that the feather belonged to one of the larger gull species, i.e. Great Black-backed Gull *Larus marinus*, Lesser Black-backed Gull *L. fuscus*, Herring Gull *L. argentatus* or Common Gull *L. canus*.

Conclusion of the feather identification work: The characters of both feathers match those of the Charadriiformes, but do not lead to one and the same species. Although both have the same colour, the feathers come from two different species. The small one (feather no. 1 on the altitude decoder) is from one of the alcid species, probably from a Guillemot *Uria aalge*. The larger (feather no. 2 from the cargo door) is most probably from one of the bigger gull species *Larus sp.*

CONCLUSIONS

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CONCLUSIONS

The two feathers from the Convair wreckage were complete (i.e. no fracture of calamus or rachis) and no blood was found on them. Thus they were most probably shed during active moult. The feathers originate from two different bird species; one Alcidae species and one Laridae species. The alcid feather is most probably from a Guillemot, while the gull feather comes from one of the larger species.

Alcids do not fly at altitudes of 22 000 feet, and can therefore be excluded as a bird strike species in connection with this accident. The feather might have been shed by one of the guillemots which regularly moult in the Skagerak in August - September (Cramp 1985).

Gulls are sometimes known to fly at very high altitudes, but 22 000 feet is very high even for a large gull. The weather conditions at the time of the accident, rainfall and very strong (60-70 knots) WSW winds, most certainly exclude even the gull from the list of possible causes of the Convair crash in the Skagerak. Gulls moult during the time of the year in which the accident took place.

The two feathers found on the wreckage have probably become attached to aircraft parts after the accident took place, and thus have no connection with the cause of the accident.

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