TRACE ELEMENT FINGERPRINTING OF BIRD FEATHERS BY WD-XRF

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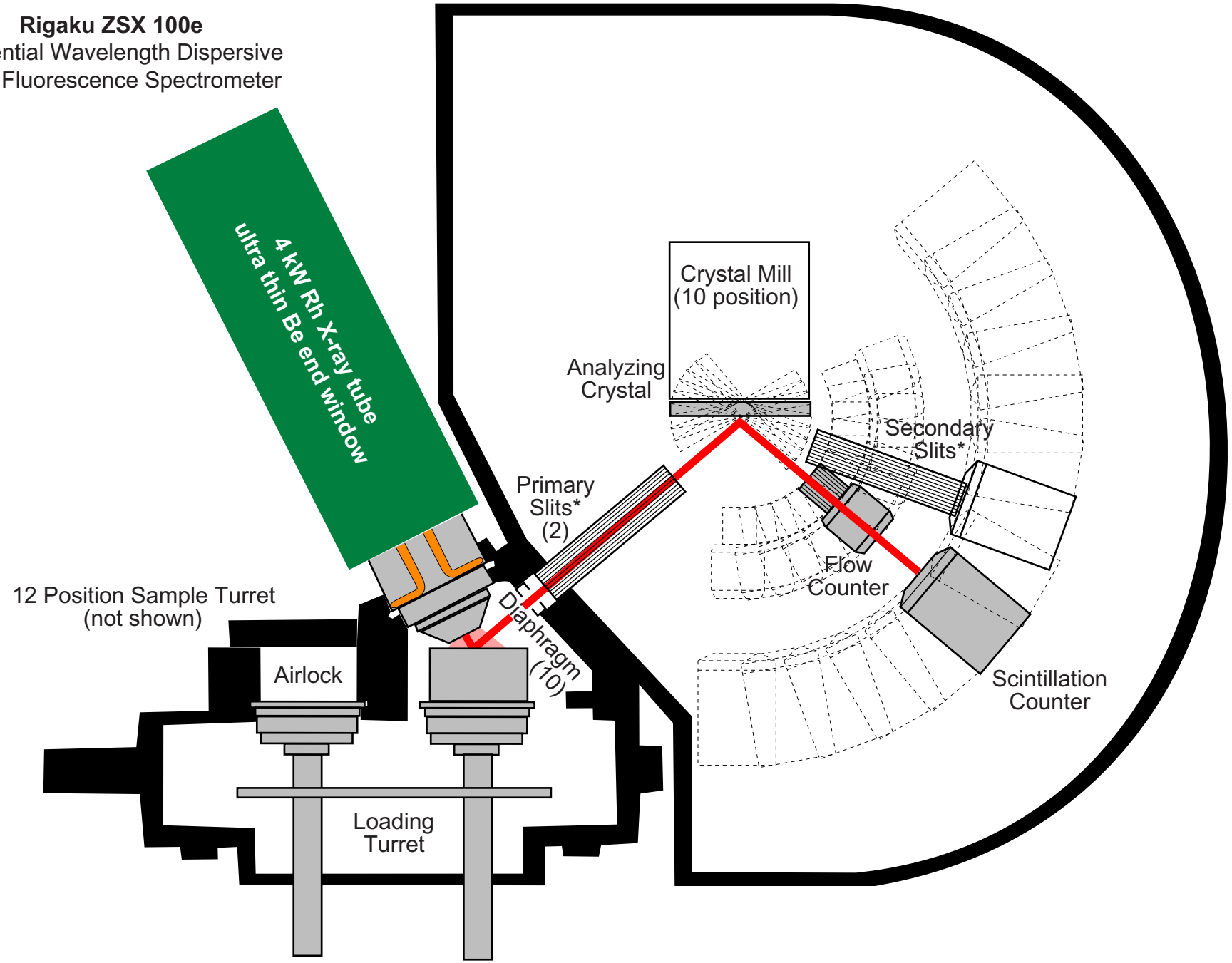
ABSTRACT–1

Of fundamental importance to conservation of neotropical migrant songbirds is determining the wintering range and habitat, and connectivity between wintering and breeding populations. Methods using stable isotopes and elemental markers are being developed and refined to help determine migrant distribution, population connectivity, and habitat use. Because feathers contain elements present in blood at the time of feather growth, isotopic and elemental markers in feathers can indicate the location, habitat use, and diet of an individual when it grew the feather.

ABSTRACT–2

We are investigating the use of wave-length dispersive x-ray fluorescence spectrometry (XRFS) for elemental "fingerprinting" of bird feathers. XRFS appears to have several advantages over other analytical techniques, in that it may require minimal sample preparation, thus providing cost-effective results with rapid turn-around. In addition, XRFS analysis is non-destructive, so the same feather material could be analyzed both for its elemental composition and its stable isotopic composition. Initial results show recognizable differences in feather composition between different species of birds.

Rigaku ZSX 100e
sequential Wavelength Dispersive
X-ray Fluorescence Spectrometer



ANALYTICAL METHODS–1

For these preliminary studies, we used a collection of dropped feathers picked up off the ground over a number of years. Feathers analyzed in this study included:

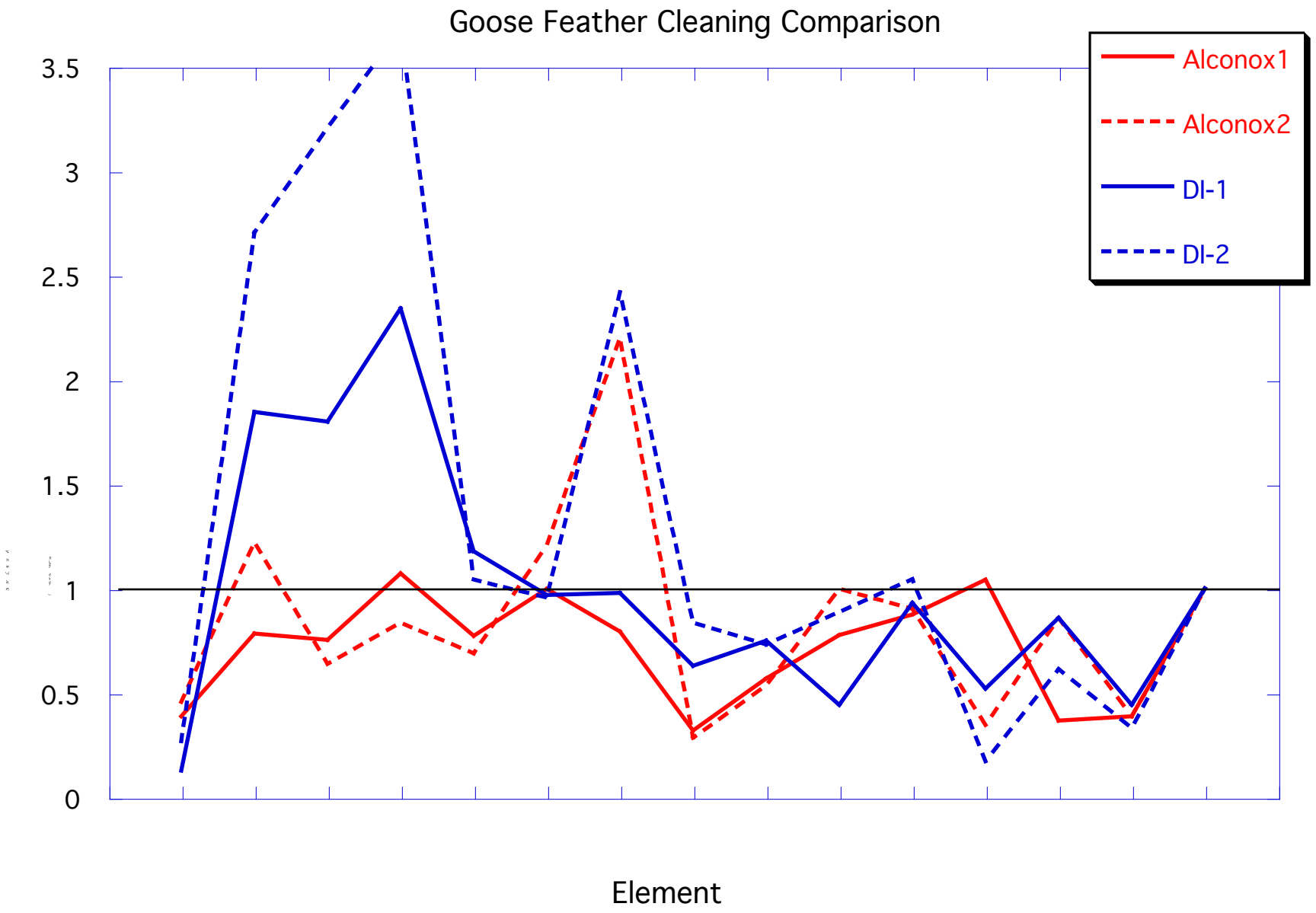
three from Northern Flickers
three from Blue Jays
four from Ring-Necked Pheasants
two from Wild Turkey
nine from Canada Geese

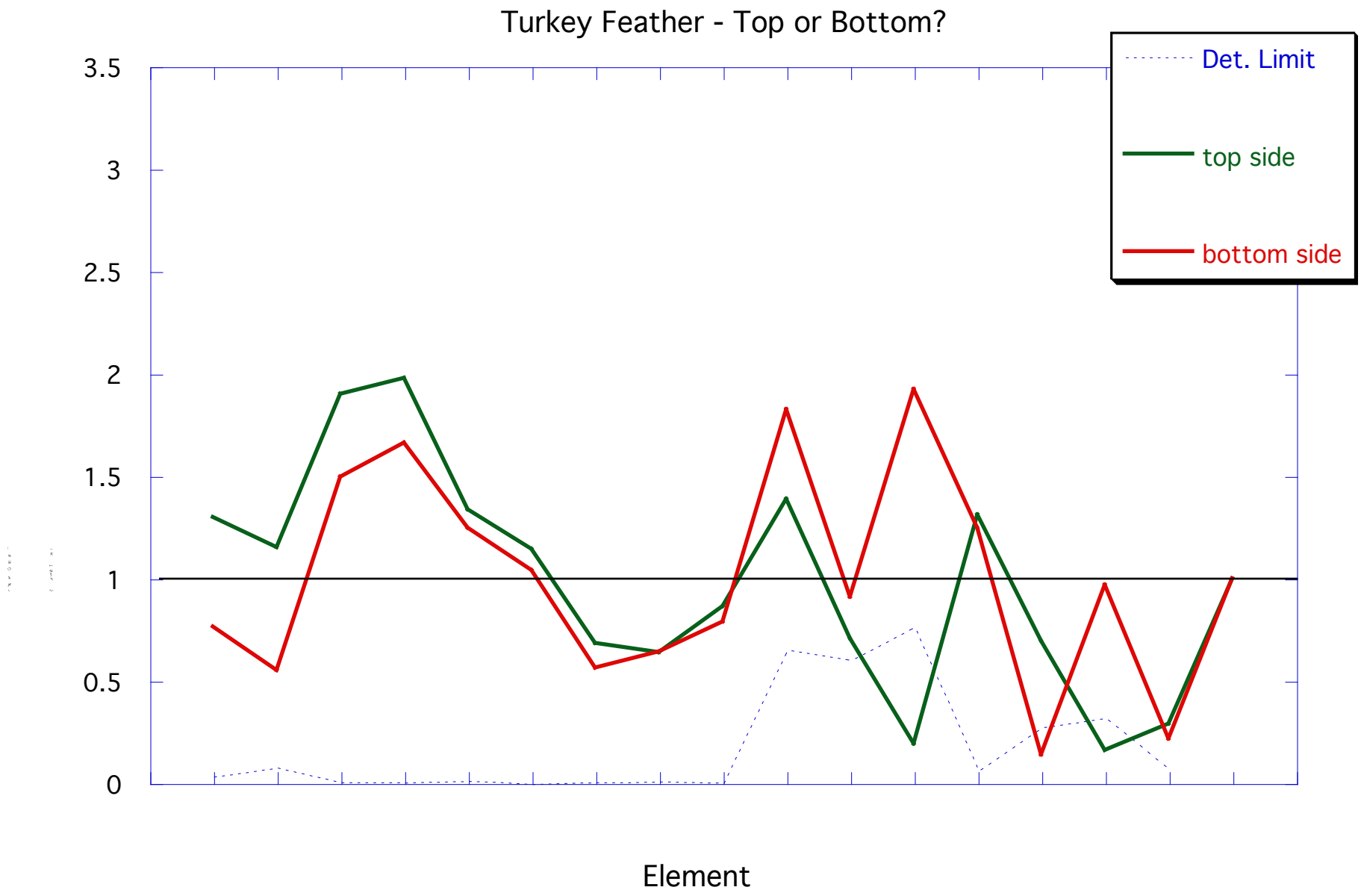
Feathers were scrubbed and rinsed with de-ionized water and dried in an oven at 78°C. Some of the Goose feathers were washed wtih Alconox and then rinsed, for comparison of cleaning methods.

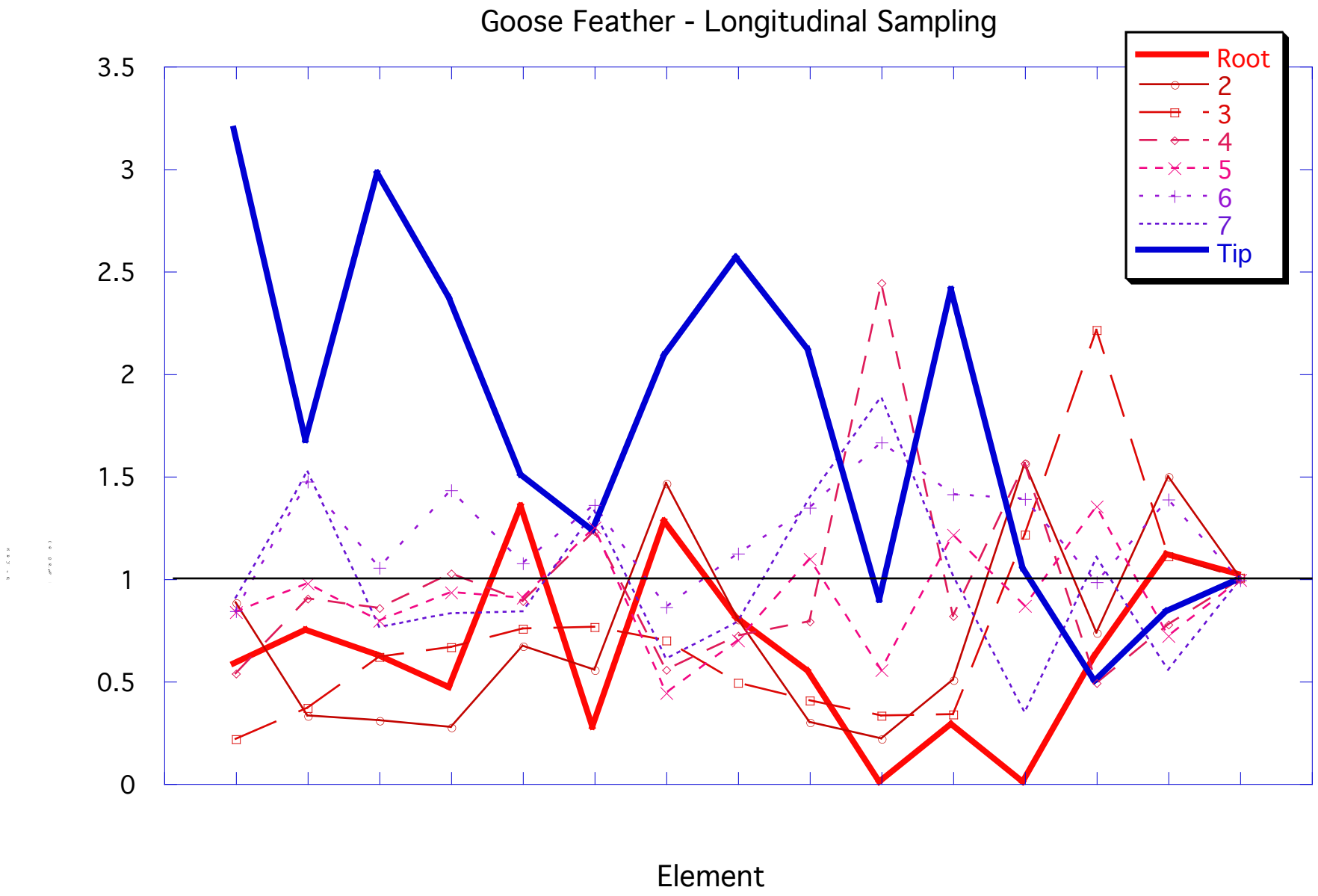
ANALYTICAL METHODS–2

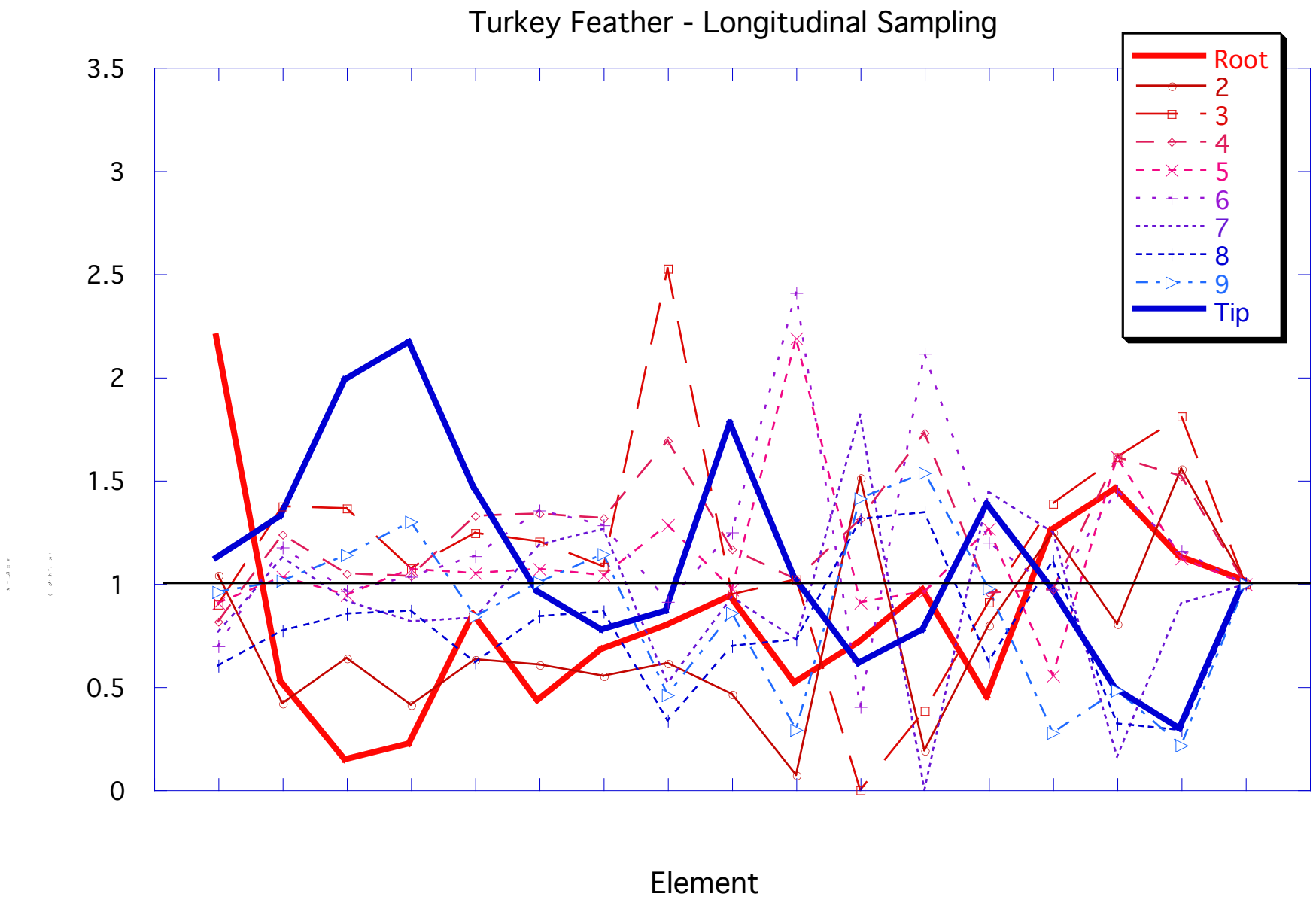
Clean dry whole feather material was cut with scissors as necessary to fit in the sample holders, with the feather spanning an empty liquid sample cup which holds it up against the sample mask.

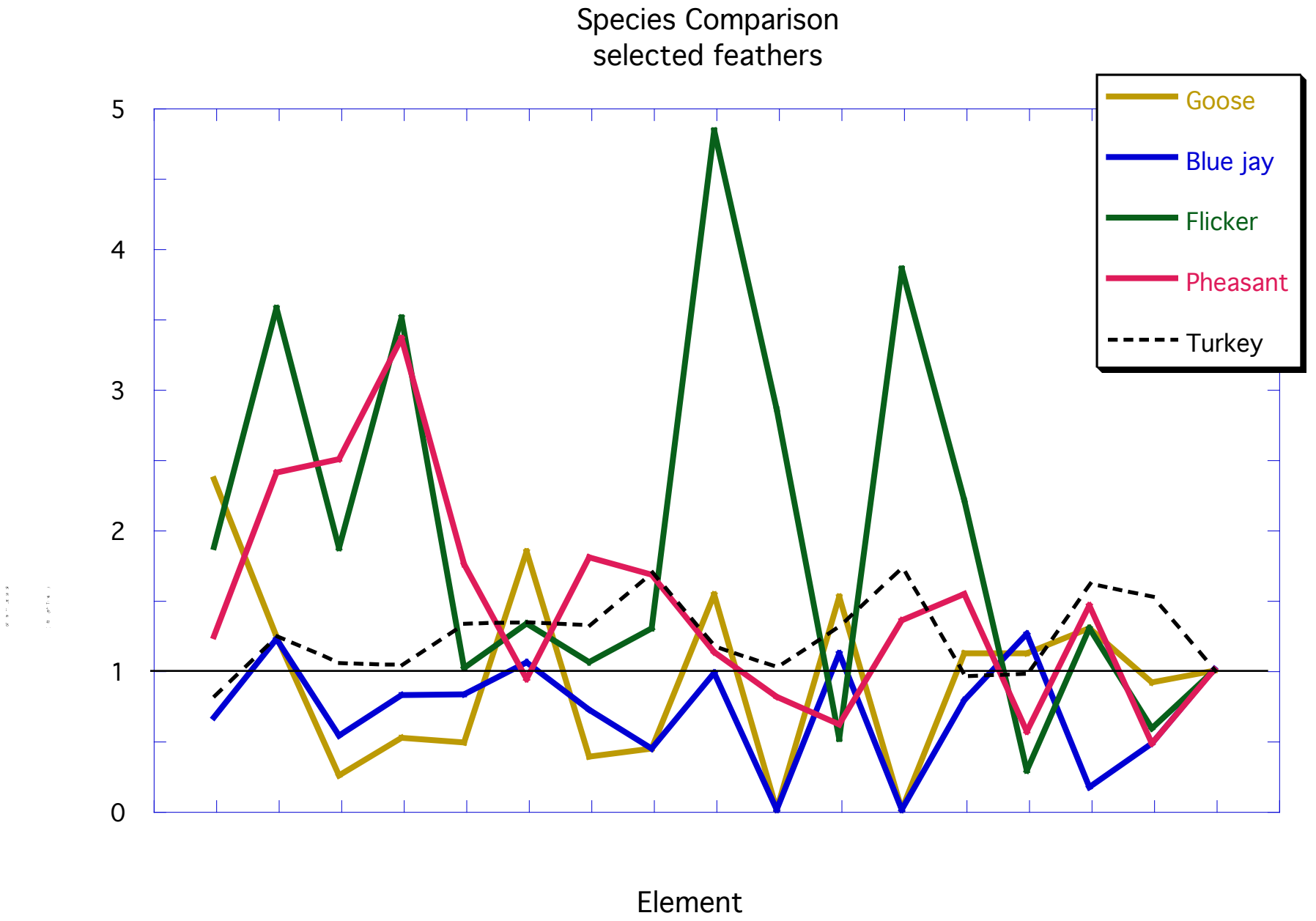
The feathers are analyzed under a vacuum using Rigaku's ZSX EZ-Scan/SQX program. Elemental concentrations are calculated from the x-ray spectral scan based on peak heights above background using an iterative "fundamental parameters" approach. All elements from F to U were accounted for by the x-ray spectral scan; a keratin protein formula was used as a "balance component" in the calculation to account for H, C, N, and O.


Goose Feather Cleaning Comparison
Alconox1
Alconox2
DI-1
DI-2
3.5
3
2.5
2
1.5
1
0.5
0
Element


Turkey Feather - Top or Bottom?
Det. Limit
top side
bottom side
3.5
3
2.5
2
1.5
1
0.5
0
Element


Goose Feather - Longitudinal Sampling
Root
2
3
4
5
6
7
Tip
3.5
3
2.5
2
1.5
1
0.5
0
Element


Turkey Feather - Longitudinal Sampling
3.5
3
2.5
2
1.5
1
0.5
0
Root
2
3
4
5
6
7
8
9
Tip
Element


Species Comparison
selected feathers
Goose
Blue jay
Flicker
Pheasant
Turkey
5
4
3
2
1
0
Element

ACKNOWLEDGEMENTS

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“I asked for a crescent wrench, this is a hammer! Dang these stone tools!” Gary Larson

“If the only tool you have is a hammer, you tend to see every problem as a nail.”Abraham Maslow