MAGNETITE AND MAGNETIC SENSITIVITY IN THE GREEN TURTLE, *CHELONIA MYDAS*

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IV. SUMMARY AND CONCLUSION

1. Magnetic material was found in the heads of green turtles of all age classes, with the highest concentration in the dura mater membrane.

2. AF demagnetization of tissue samples showed that the material was magnetically hard, or stable.

3. The magnetic material was extracted from dura mater and facial muscle by tissue digestion, centrifugation, and magnetic isolation.

4. Analysis of dura mater material via X-ray diffraction and electron microprobe demonstrated that the material was very pure magnetite, with negligible amounts of non-ferrous elements present.

5. Scanning electron microscopy of dura mater material revealed two crystal types; a colloidal crystal and several spheres. The crystals may be composed of smaller magnetite subunits. A third crystal type was observed in a facial muscle sample. This crystal was not positively identified, but is probably ferrihydrite.

6. Behavioral studies using classical and operant conditioning techniques were conducted to determine if juvenile turtles could discriminate between normal and altered magnetic fields. One animal showed discrimination between the two field conditions, while positive results were not obtained with the other turtles tested. Negative results could indicate that the turtles do not sense field changes, or may result from methodological difficulties.

The question of whether magnetite is the sensory transducer to the nervous system of magnetic field information has yet to be answered. Evidence that the green turtle, like many other vertebrates, synthesizes magnetically-stable magnetite and concentrates the mineral in the anterior of the head, lends credence to the hypothesis that the magnetite is a component in some sensory system, possibly that of magnetic field detection.

A geomagnetic sensing mechanism would be of significant evolutionary advantage to an open-ocean migrant. Baldwin's observations (discussed in the Introduction) and my results with Turtle A support the hypothesis of such a mechanism in the green turtle. Further research must examine the association of magnetite with the turtle nervous system, and must utilize more appropriate behavioral testing regimes in order to clarify the role of magnetite and magnetic orientation in the migrations of the green turtle.