Course Syllabus

Geomagnetism, Paleomagnetism and Environmental Magnetism
MWF 4th Period

Instructors:
Dr. Joseph Meert (M), Dr. Courtney Sprain (S), Dr. Robert Hatfield (H)

Office Hours:
TBD

Contact Information:

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Courtney Sprain: XXX Williamson Hall, **csprain@ufl.edu (mailto:csprain@ufl.edu)** (651-757-8324, Cell), (352-294-6319, Office)
Rob Hatfield: 220 Williamson Hall, **rhatfield1@ufl.edu (mailto:rhatfield1@ufl.edu)** (352-XXX-XXXX, Office)

Textbooks:

Robert Butler: Magnetic Domains to Geologic Terranes (free **download** **(https://www.geo.arizona.edu/Paleomag/)**)
Lisa Tauxe: Essentials of Paleomagnetism (free **online** **(https://earthref.org/MagIC/books/Tauxe/Essentials/)**)
Software: Download **GMAP** **(http://www.earthdynamics.org/earthhistory/gmap_info.html)** and **IAPD** **(http://www.iggl.no/resources.html)**
Software, **https://paleointensity.org/,** **(https://paleointensity.org/,)** python and pmagpy (instructions for download **here** **(https://earthref.org/PmagPy/cookbook/)**), Matlab (get access with **UFApps** **(https://info.apps.ufl.edu/)**)

Course Description

This course will serve as a comprehensive overview of Geomagnetism (how the magnetic field is generated, how we use models to assess how it has changed in recent and ancient time), Paleomagnetism (using rocks to interpret the magnetic field and past history of continental motion and true polar wander, in addition to evolution of the deep interior) and Magnetostratigraphy and Environmental magnetism (how we can use the magnetic information encoded in sediments and rocks to tell us about changes in earth history). It is intended for junior/senior level undergraduates and graduate students. While there are no prerequisites, useful background courses/familiarity with physics (electromagnetism in particular), statistics and calculus (the more the merrier) will be helpful.

Part 1- Basics of Paleomagnetism (Meert)

Week 1 (Jan 11)- Basic Structure of the Geomagnetic Field, Geocentric Axial Dipole model, Principles of magnetism basics, basics of magnetism in rocks

Lecture 1 (MSH)- Introduction to course Meert, Sprain, Hatfield. History of UF paleomagnetism
Lecture 2 (M)- Overview of origins of the Geomagnetic field, GAD axial dipole, secular variation.
Lecture 3 (M)- Principles of magnetism in natural materials, domain sizes and magnetic mineralogy-1

Week 2 (Jan 18 MLK no school)- Domain theory, types of magnetic remanence, common rocks and minerals used in paleomagnetism, Sampling, measurement and instrumentation.

Lecture 4 (M)- domain sizes and magnetic mineralogy, hysteresis, Curie temps-2
Lecture 5 (M)- Common minerals and rocks, the alphabet soup of RM's (remanent magnetizations).

Week 3 (Jan 25)- Demagnetization, Analysis of vector components (PCA, Linefind etc, Great circle analysis), statistical methods in paleomagnetism,

Lecture 6 (M)- Sampling techniques and strategies, lab instrumentation available at UF.
Lecture 7 (M)- Demagnetization and analysis of vector components (Z-plots).
Lecture 8 (M)- Basic statistical methods applied to paleomagnetic data, great circle analysis-1

Week 4 (Feb 1)- Paleomagnetic poles, euler poles, APWP's, statistics

Lecture 9 (M)- Statistical analysis of paleomagnetic data-2
Lecture 10 (M)- Vector space to pole space, VGP's, paleomagnetic poles
Lecture 11 (M)- euler pole rotations, Apparent polar wander paths, importance of age control-**1**

Week 5 (Feb 8)- Apparent polar wander paths, reconstructions, reliability criteria

Lecture 12 (M)- Apparent polar wander paths, True polar wander and euler poles-2
Lecture 13 (M)- Reliability criteria
Lecture 14 (M)- Continental reconstructions using paleomagnetism

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Week 6 (Feb 15)- Dr. Sprain & Meert

Lecture 15 (M)- Using GMAP as an introduction to making reconstuctions.
Lecture 16 (S)- The geodynamo and dynamo theory pt. 1
Lecture 17 (S)- The geodynamo and dynamo theory pt. 2

Week 7-(Feb 22)

Lecture 18 (S)- Geomagnetism and secular variation, what's the field doing today? pt. 1
Lecture 19 (S)- Geomagnetism and secular variation, what's the field doing today? pt. 2
Lecture 20 (S)-Introduction to paleointensity

Week 8- (Mar 1)

Lecture 21 (S)-Paleointensity reliability criteria

Lecture 22 (S)- The determination of paleointensity activity-paleointensity.org
Lecture 23 (S)- Paleosecular variation and the Time-average field pt. 1-data

Week 9 (Mar 8)

Lecture 24 (S)- Paleosecular variation and the Time-average field pt. 2-models
Lecture 25 (S)- Paleosecular variation and the Time-average field activity-Determining S and Inclination Anomaly
Lecture 26 (S)- Connecting long-term magnetic field trends to the evolution of the deep interior pt. 1

Week 10 (Mar 15)

Lecture 27 (S)- Connecting long-term magnetic field trends to the evolution of the deep interior pt. 2
Lecture 28 (S)- Connecting long-term magnetic field trends to the evolution of the deep interior: Case study-inner core nucleation
Lecture 29 (S)-Connecting long-term magnetic field trends to the evolution of the deep interior: Activity using geodynamo simulations and real magnetic data.

Week 11 (Mar 22)- Dr. Hatfield

Lecture 30 (H)- Introduction to magnetostratigraphy
Lecture 31 (H)- Sedimentary records of the geomagnetic field
Lecture 32 (H)- Relative Paleointensity pt.1

Week 12 (Mar 29)

Lecture 33 (H)- Relative Paleointensity pt.2
Lecture 34 (H)- Activity: Chronostratigraphic Applications
Lecture 35 (H)- Introduction to Environmental Magnetism

Week 13 (April 5)

Lecture 36 (H)- Fundamental Rock Magnetism pt.1
Lecture 37 (H)- Fundamental Rock Magnetism pt.2
Lecture 38 (H)- Environmental Magnetism: a rock magnetic toolkit

Week 14 (April 12)

Lecture 39 (H)- Using the rock magnetic toolkit (Activity)
Lecture 40 (H)- Particle Size Specific Magnetic Measurements
Lecture 41 (H)- Environmental Magnetic Applications: Paleoclimate

Week 15 (April 19)- End of Course

Lecture 42 (H)- Environmental Magnetic Applications: Pollution
Lecture 43 (MSH)- Course Summary and Perspectives

Grades:

Student Honor Code:

We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity by abiding by the Student Honor Code. On all work submitted for credit by Students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.”

Course Summary:

Date	Details