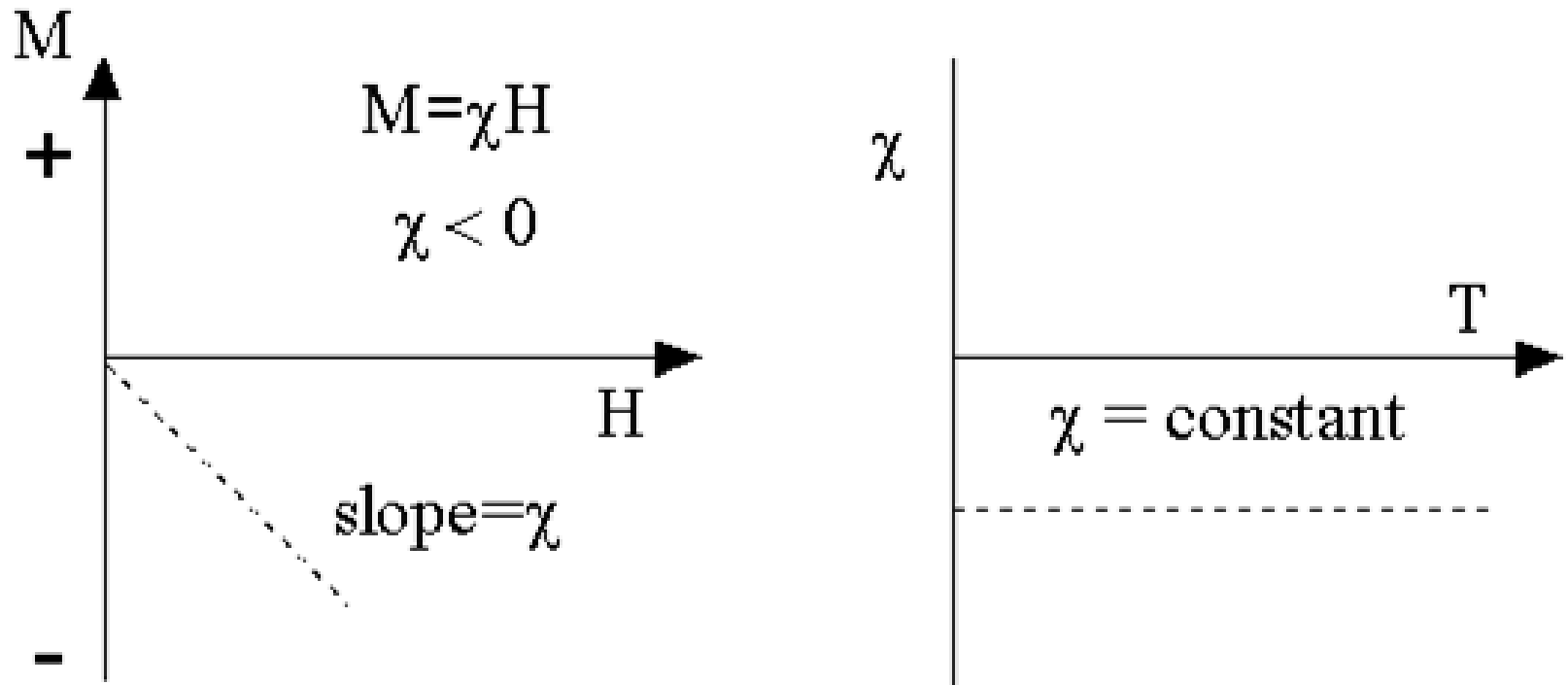




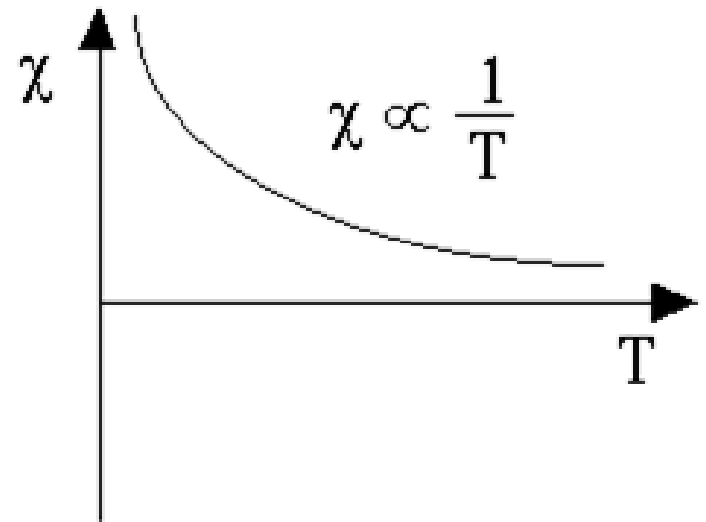
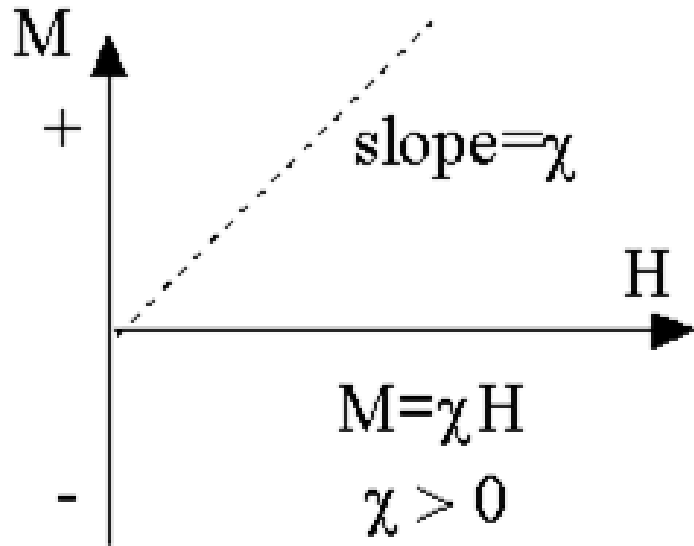
Introduction to Magnetic Measurements - Hysteresis

Dr. Eduard Petrovsky
Institute of Geophysics CAS
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Diamagnetism

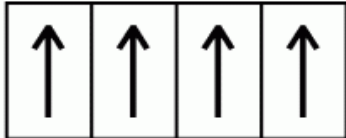

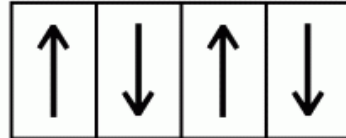
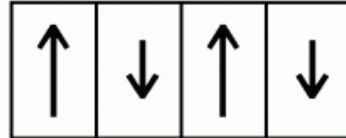

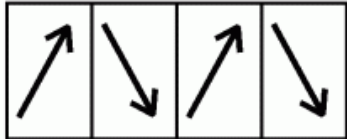



Paramagnetism

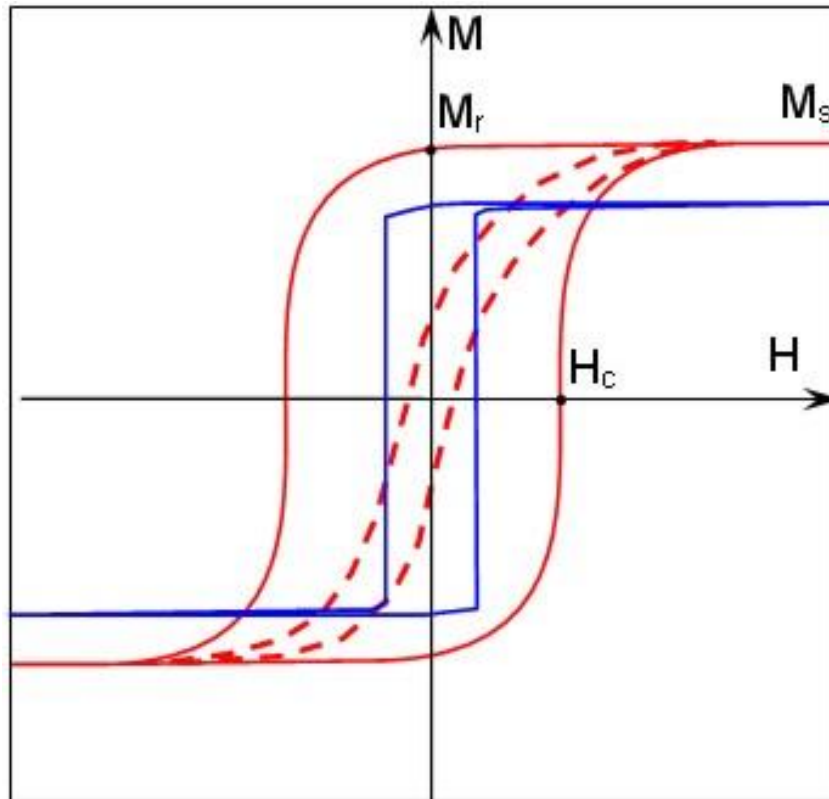


Ferromagnetism

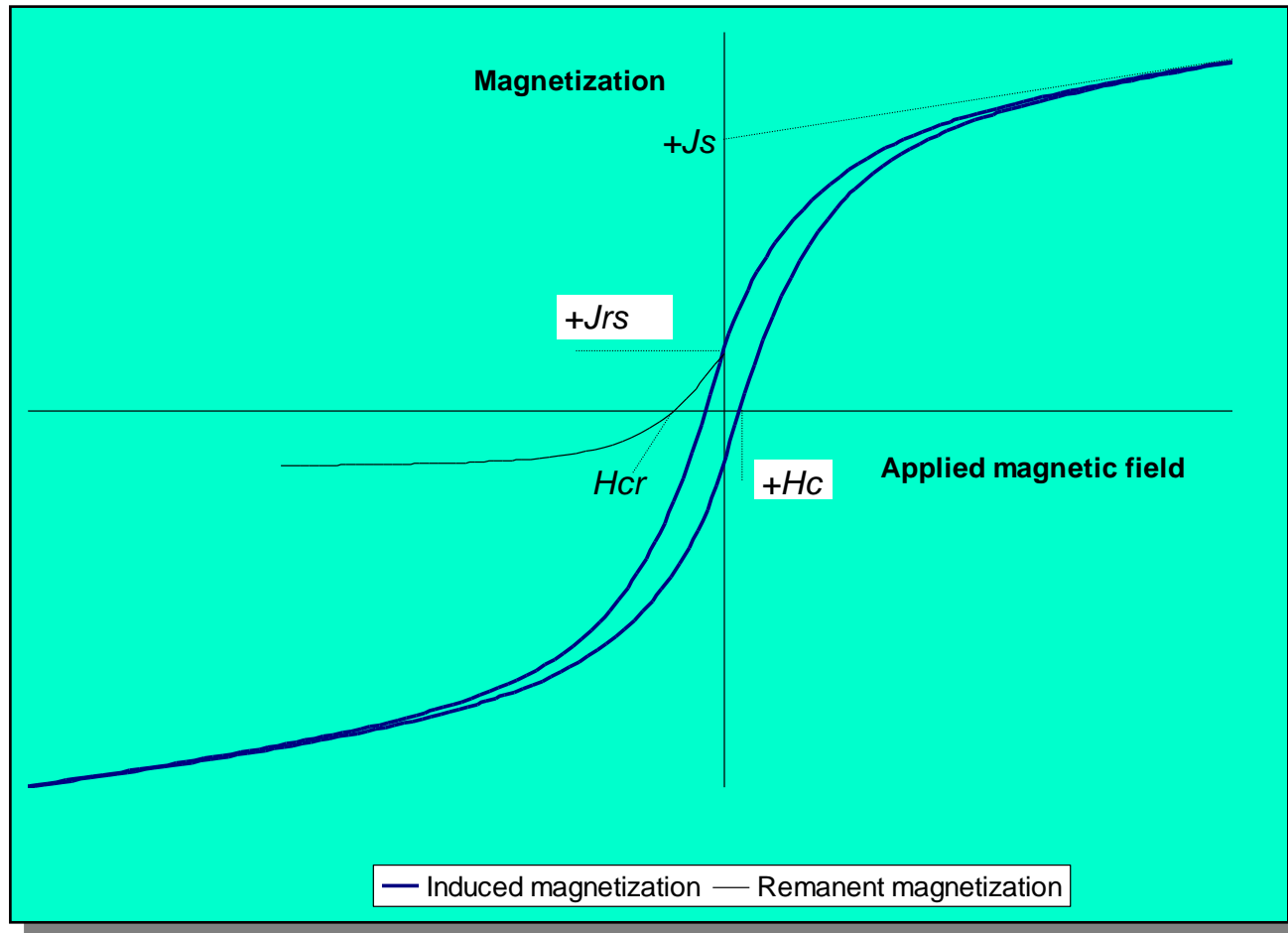
For T above T_c , spontaneous alignment of magnetic moments vanishes due to thermal excitations and susceptibility behaves like in case of paramagnetism, but with individual atomic moments coupled rather than individual.

Type	Arrangement	Lattice	Resultant
true ferromagnetic (Fe, Ni, Co)	alignment within lattice		
antiferromagnetic	sublattices, A & B, aligned but antiparallel, equal		(none)
ferrimagnetic	sublattices, A & B, aligned antiparallel, unequal		
canted antiferromagnetic	sublattices, A & B, canted equal		

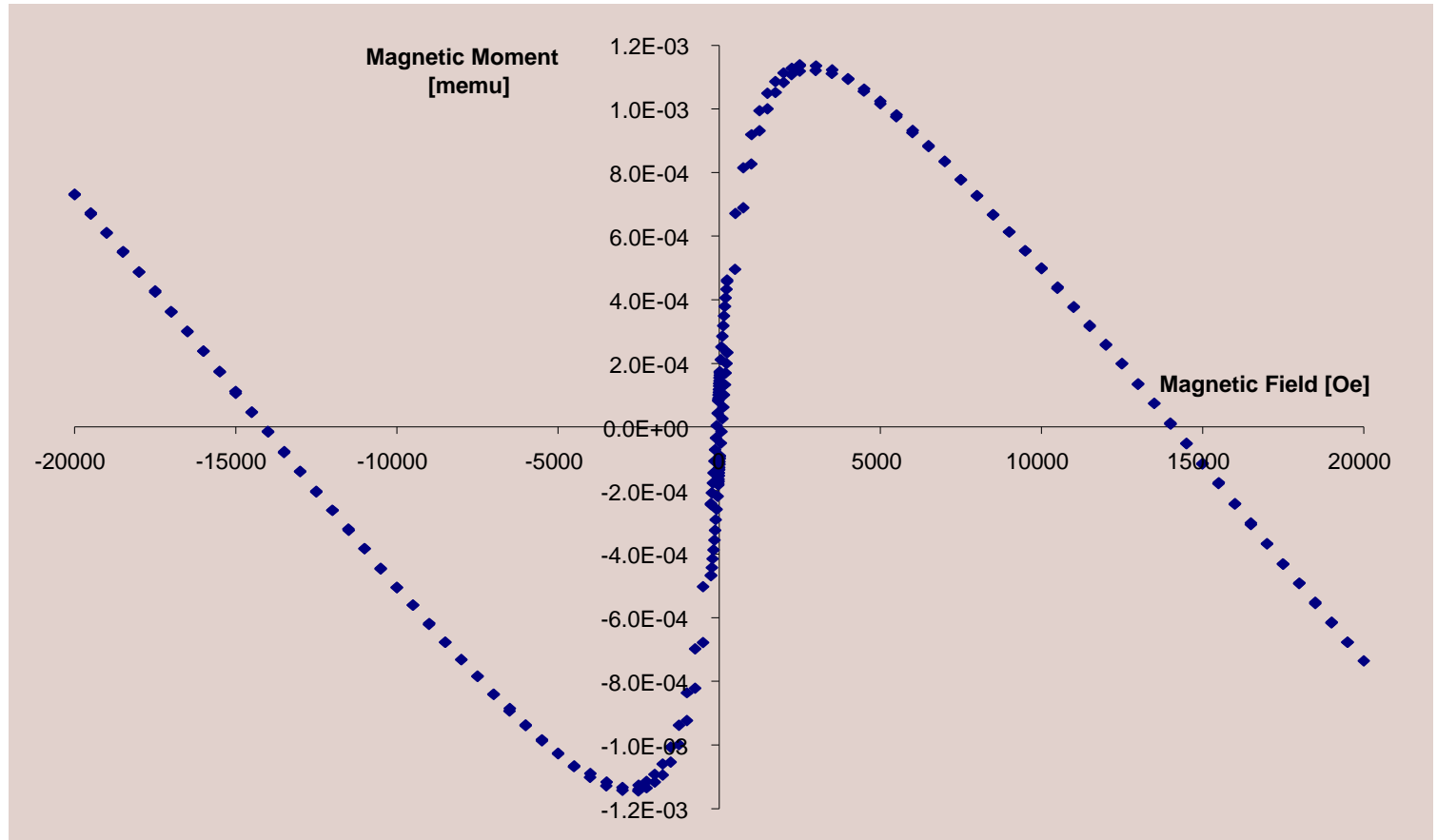
Ferromagnetism



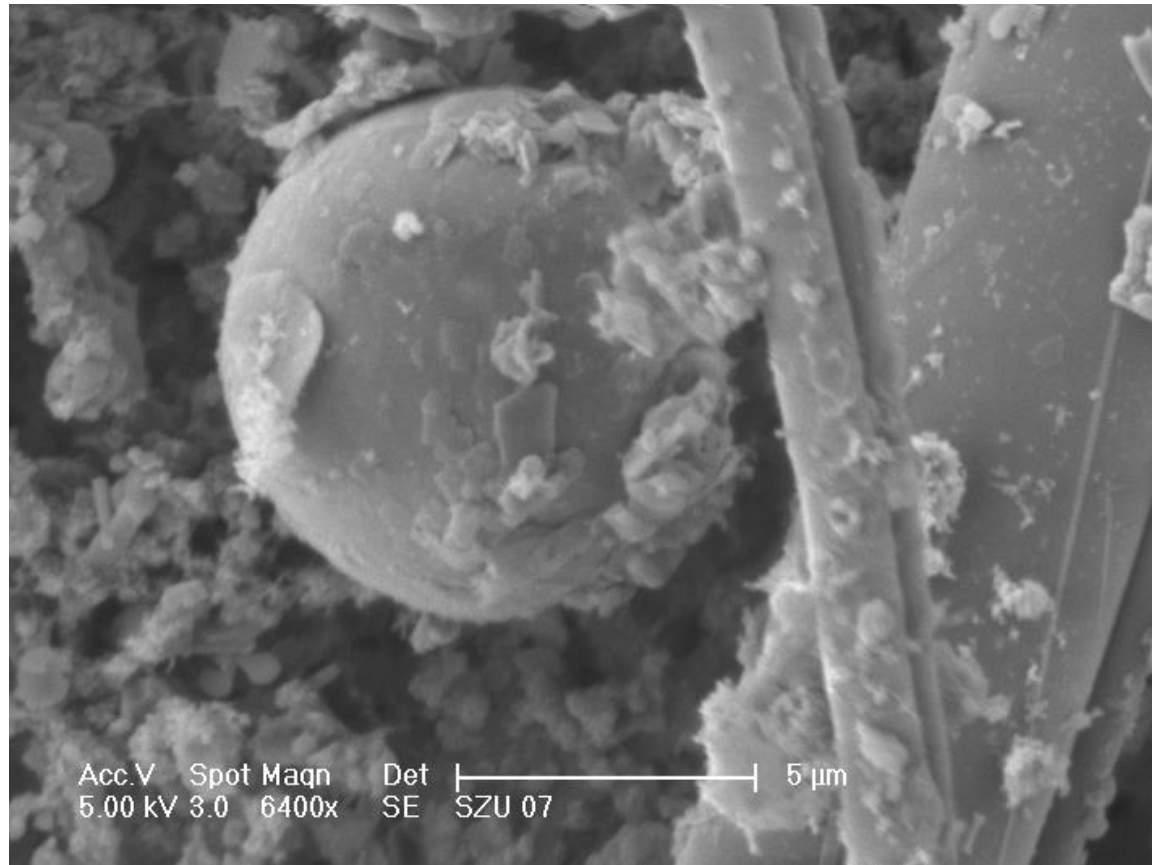
Ferromagnetism + ???



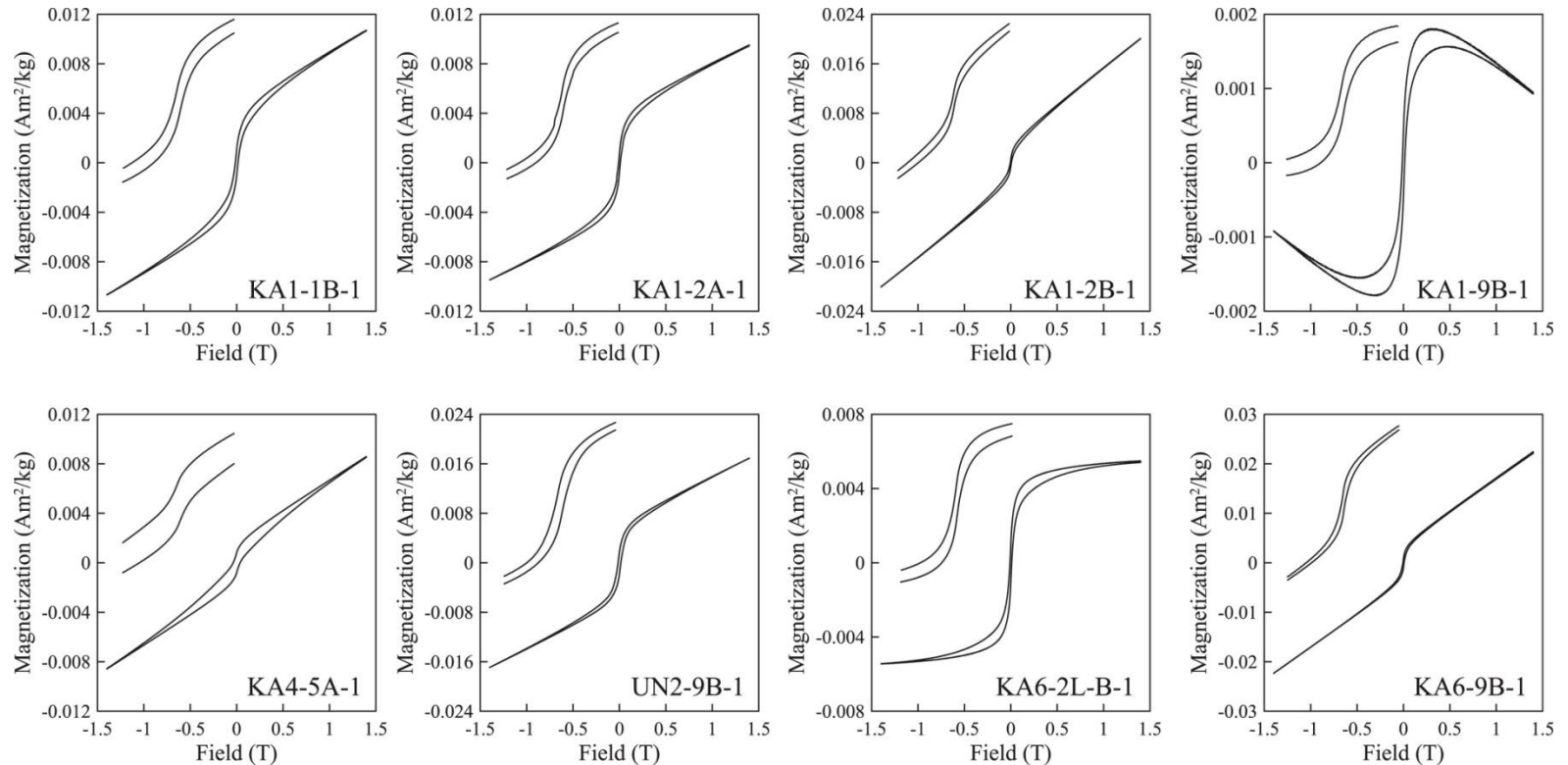
??magnetism



Diamagnetic quartz fibres with few iron-rich spherules from the atmosphere

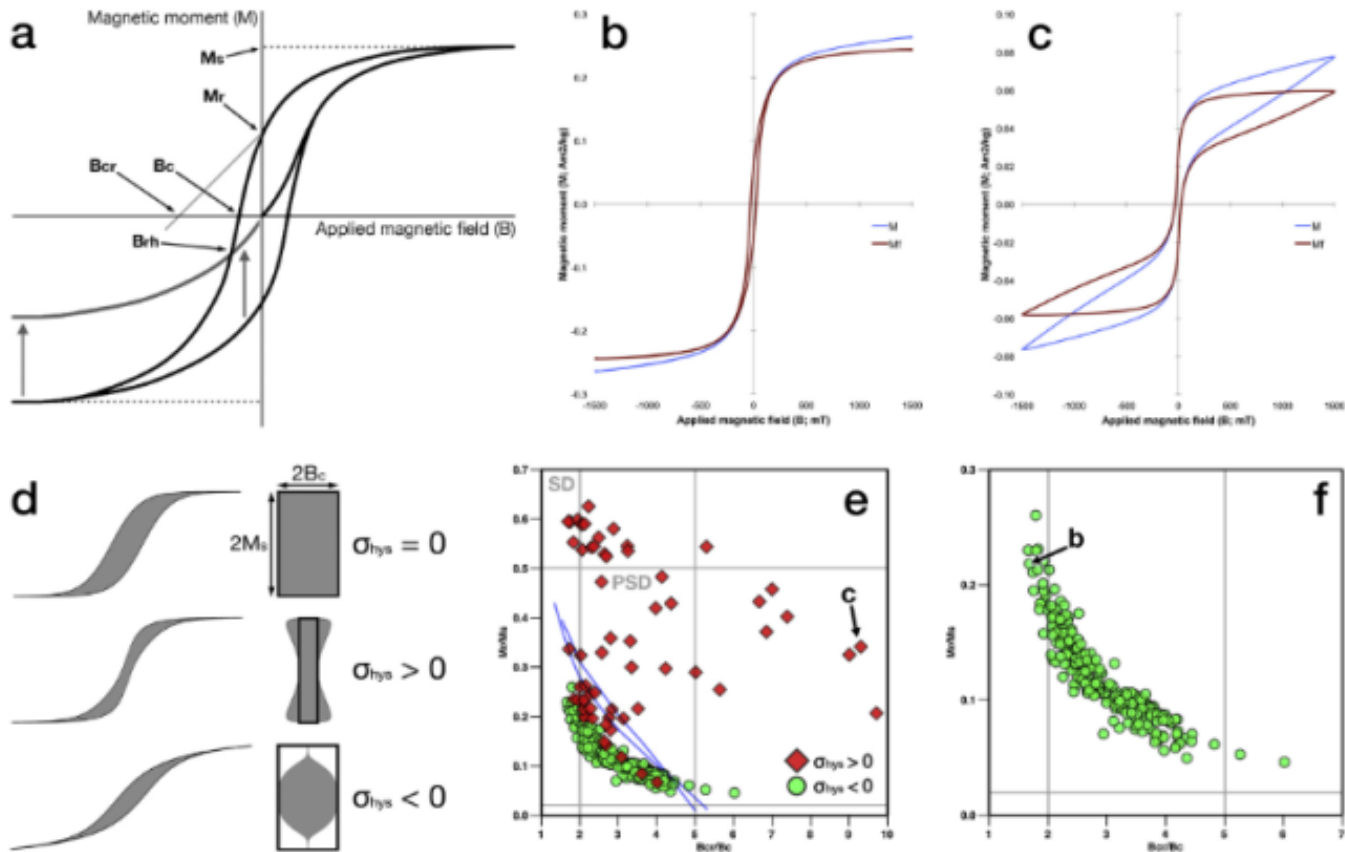


Wasp-waisted loops



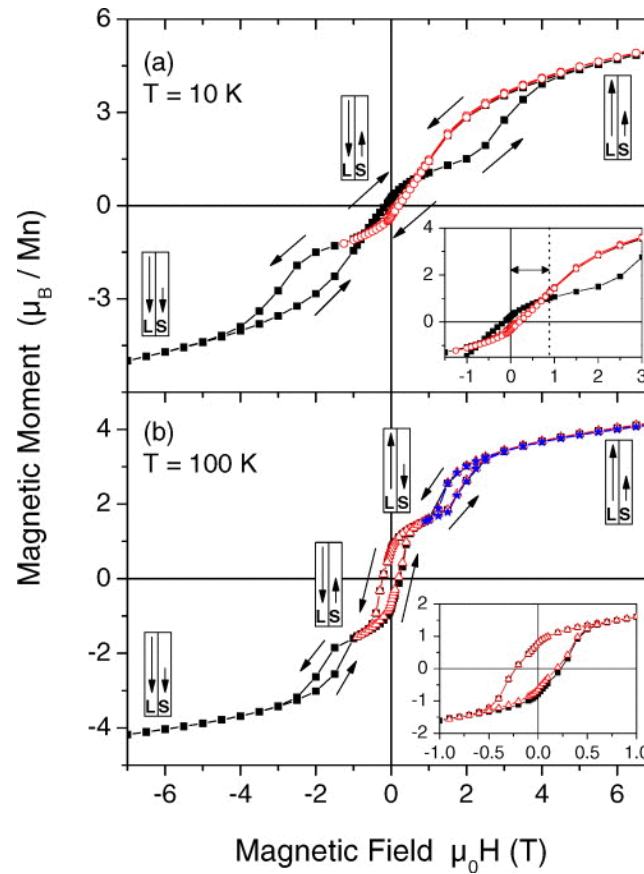
Hu et al., JGR-Soild Earth, 2020, DOI 10.1029/2020JB019518

Wasp-waisted and pot-bellied



Frahm et al., *J. Archaeol. Sci.*, 2014, DOI 10.1016/j.jas.2014.04.015

Inverted loops



Ziese et al., *Appl. Phys. Lett.*, 2010, DOI 10.1063/1.3470101

Vibrating-Sample Magnetometer (ADE EV9 VSM)

- Field -2.6 to +2.6 T
- Temperature from LN2 to 750°C
- Field resolution from 0.001 to 1 Oe, with the noise of 0.004 to 0.05 Oe, respectively
- Accuracy of magnetic moment is $\pm 1\%$ + noise

