‘Microgeodynamics’

(small scale study of large scale Earth deformation)

Main crystal technique: SEM-EBSD

(FEI650 FEGSEM + Oxford AzTec EBSD)

Group Members (all SOEE)

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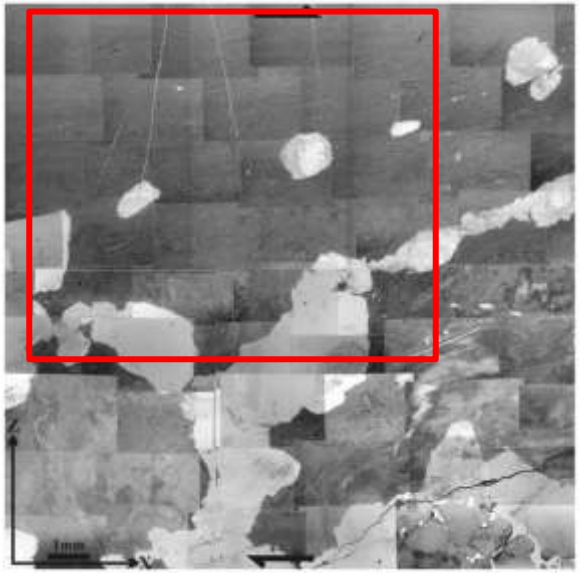
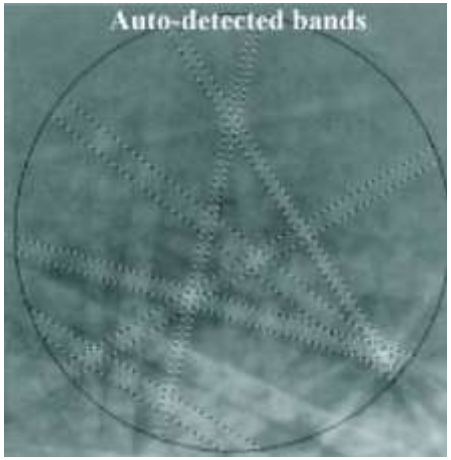
1. NERC PhD award
2. NERC-CASE (NMS) PhD award
3. Tied PhD (Fault Lab *DANA* project)

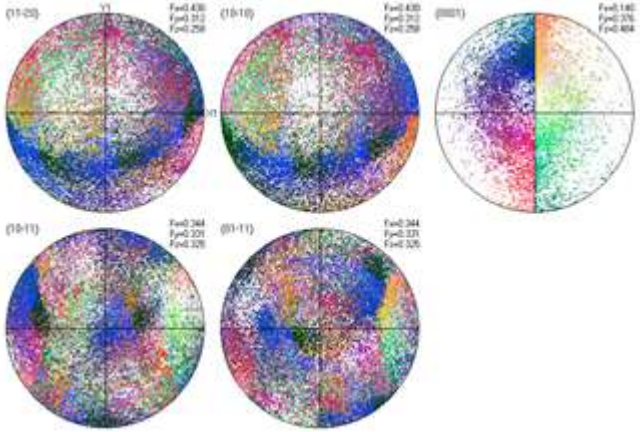
Basic Methodology 1

1. SEM BSE/FSE OC image of crystallographic microstructure (quartz + feldspar shear zone)

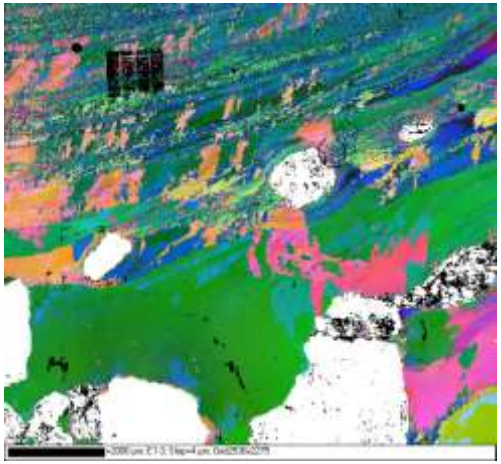


2. Automatically scan & collect/index EBSD patterns: (~100nm spatial & ~1° angular resolutions ; 1 - >10^6 datasets; 10 – 20 patterns/sec indexing rates.





3. Automatically calculate colour-coded crystal pole figures (CPO) for any direction/plane



4. Colour-coding superposed on to OC images

Results used to interpret regional scale tectonics (e.g. deformation type, kinematics, conditions, etc.).

Current projects in NW Scotland, Himalaya (Karakorum, Annapurna) & Turkey.

Can also be used to contribute to regional tectonic & geodynamic studies based on seismology …

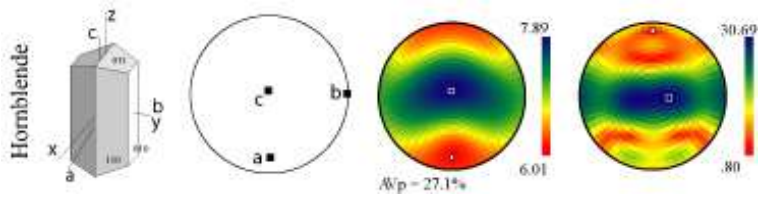
Basic Methodology 2

EBSD data enable calculation of anisotropic tensorial rock properties (e.g. seismic velocities & anisotropies in 3D):

- combine each EBSD orientation in sample coordinates with the single crystal elastic property in crystal coordinates, to evaluate the elastic property in sample coordinates.

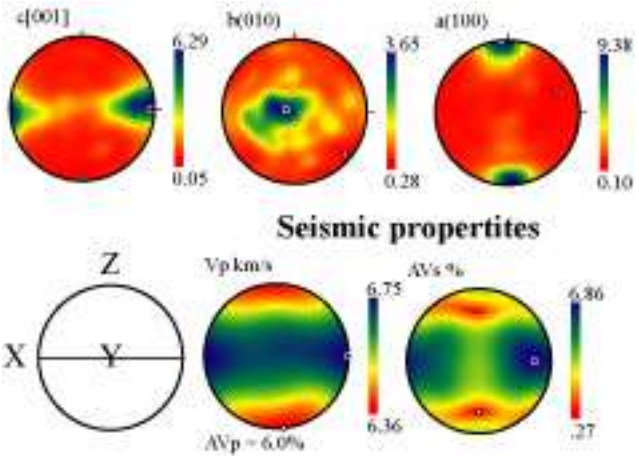
- calculate aggregate elastic properties (integrate over all possible orientations).

- calculate orthogonal seismic phase velocities (Vp, Vs_1, Vs_2) via the *Christoffel* equation



Example: single crystal seismics

Example: polycrystal seismics



Example: 'rock recipes'& crustal seismics