Experimental report

01/09/2017

Proposal: 1-02-202 **Council:** 4/2016

Title: Quantitative Texture Analysis in sandstones: a tool to infer flow directions for structural analysis andresource exploitation.

Research area: Other...

This proposal is a new proposal

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Samples: silicates

Instrument	Requested days	Allocated days	From	To
D1B	6	3	03/10/2016	06/10/2016

Abstract:

This project aims at studying the control of the crystallographic preferred orientation (textures-QTA) on the anisotropy of the magnetic susceptivity (AMS) and their relation with structural and mechanical anisotropies in sandstones. Sandstones commonly occur in marine sediments as products of slow to turbulent submarine floods of detrital material and may become excellent reservoir for oil and gas. In order to assess the present-day position of reservoirs, the flow direction structures in past sandstones are used. This is commonly done by studying micro-structures from drill-cores. Here we suggest to use the texture analysis as a non-destructive and statistically reliable approach to obtain flow orientations compared to the classical one. We will combine two aspects that relate flow direction with textures: i) the crystallographic preferred orientations of rock-forming minerals, ii) the relation between the ODF and the AMS magnetic, property measured on the same samples. The results will define important steps on the basic understanding of sandstone processes and will open an innovative use of texture analysis in geo-resources fields.

Determining flow directions in turbidites using neutron diffraction of the Aveto Formation (Lower Oligocene) and the Arenarie di San Salvatore (Lower Miocene)

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Abstract

Flow direction in turbidites is related to hydrocarbon reservoir position; Lattice Preferred Orientation of mica and quartz is known to be related to flow direction of turbidite, though quantitative data are still poorly known. In order to evaluate the Lattice Preferred Orientation of rock-forming mineral of sandstone samples we used the non-disruptive method of lattice preferred orientation by neutron diffraction texture analysis, or Quantitative Texture Analysis (QTA), successfully applied on various types of rocks, from simple monomineralic quartzites, marbles, limestones, dunite or glaucophanite to more complex poly-phase rocks, as amphibolite, quartz-feldspatic mylonitic orthogneiss, subacqueous lavas or sandstones.

Results from experiment 1_02_202 show that chlorite, white mica and quartz LPO (Fig. 1) are closely and strongly related with flow directions which have been measured in the field.

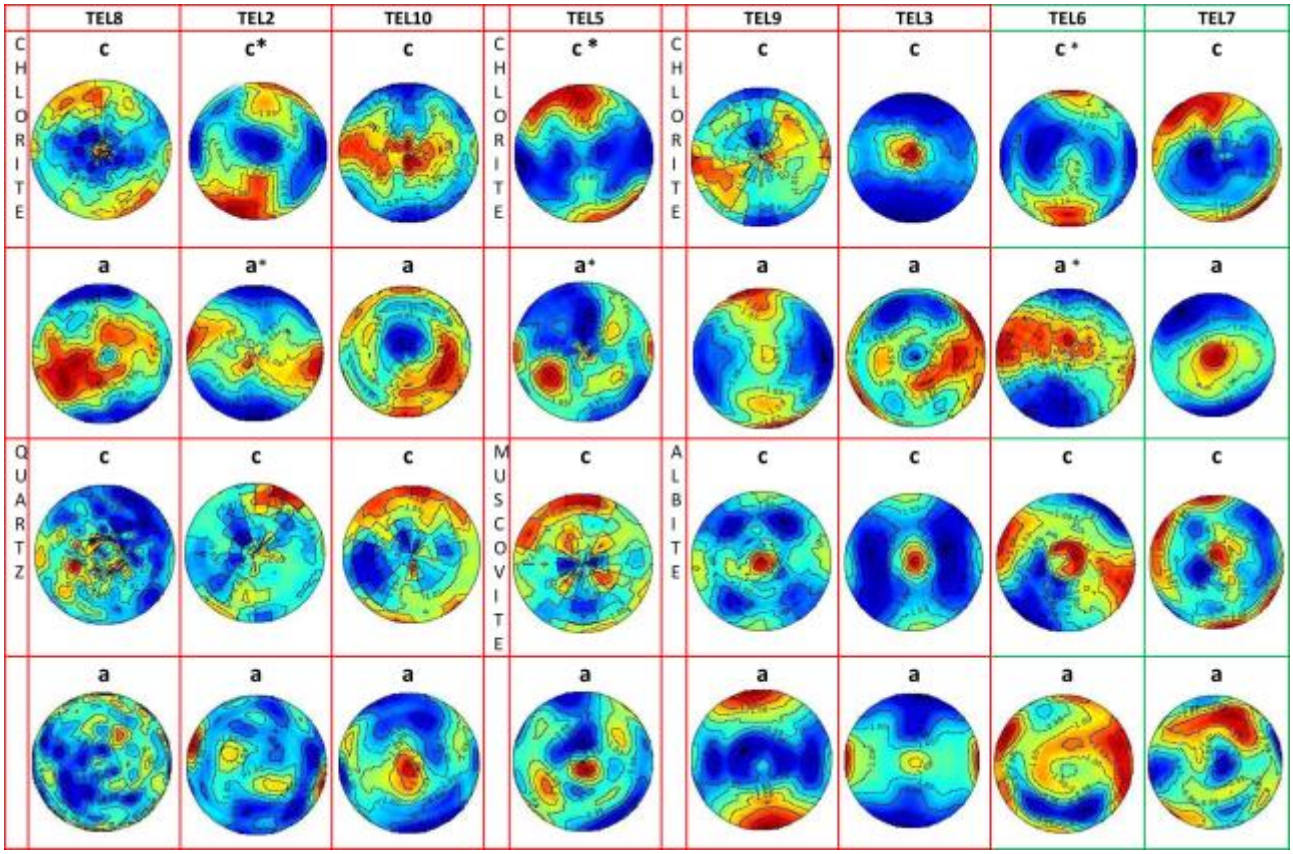

Figure 1 List of pole figures for any sample. the attention is focused on pole figures indicating poles of planes that intersect c and a axes. (the red edge contains samples belonging to Aveto Formation, the green these belonging to Bobbio Formation).

Interpretation

Figure 1 contains the pole figures refers to plane orthogonal to c and a axis. The first is the best representative of anisotropy of chlorite's basal surface; the second is the axis parallel to the flow direction so is useful to analyse the distribution of the planes intersected with it.

Looking the Figure 1 it is possible to see as the pole figures attributed to chlorite and its c axis can be separated into two groups: the first contains all these pole figures that indicates a distribution of poles inside two cluster located along flow direction or with an angle of 20° respect this. (Example pole figure of c axis of TEL 5 and TEL7 samples); the second group is composed by pole figures containing poles located inside a cluster or a girdle positioned at the centre of figure.

The pole figures attributed to a axis, indicates a distribution extremely coherent with the pole figure attributed to c axis. In fact, the distributions of poles correspond to plane located orthogonal to the planes linked with poles distributions attributed to c axis. All these characteristics indicate a good quality of ODF; this idea is confirmed by Rw and Rb values.

The pole figures attributed to quartz are characterized by a weak iso-orientation, this is a demonstration of a homogeneous distribution of quartz inside considered samples. The muscovite pole figures are available just for one sample (TEL5) and its pole figures attributed to c and a axes, are coherent and really similar to pole figures of chlorite, described before. The pole figures of c axis, attributed to albite of sample TEL 9 and TEL3 indicate a cluster of poles located at the centre of figures. Differently the pole figures of a axis, indicate a different behaviour, in fact the poles are grouped inside two clusters located, for TEL9, as the direction of flow direction; instead for TEL3 the poles are located orthogonal. The pole figures of last two samples, show for the c axis, a distribution of poles organized as clusters located with a counterclockwise rotation of 20° respect the direction of flow.

Comparison of different methods