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ANIMA: AN IMAGE ANALYSIS PROGRAM FOR DISCONTINUITIES MAPPING.

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Introduction

Various types of porosity characterize rocks: pores, vacuoles, joints between mineral grains, cracks, etc. All of these defects can be present in a given rock at the same time. Nevertheless, their role and importance in the fluid percolation phenomena are different. Indeed, matrix porosity is poorly developed in igneous rocks (Brace, 1984) and the permeability is essentially controlled by fractures and cracks. These discontinuities constitute the main fluid flow pathways. At microscopic scale, sealed or partially sealed cracks and fluid inclusion planes are the witnesses of large and durable fluid percolation (Roedder, 1984; Cathelineau et al., 1994; Lespinasse and Cathelineau, 1990; Pecher et al., 1985). They represent reliable structural markers to reconstruct the geometry of paleofluid migrations (Lespinasse and Cathelineau, 1990), and to estimate the fossil permeability. Their structural organization is moreover linked directly to the regional tectonic stresses.

Automatic image analysis is a good and fast tool for quantitative studies on many objects. However, for cracks recognition, pictures are too complex and it's very difficult to realize analysis without heavier image treatments. In general, manual digitalization is impossible to avoid, but until now, in cracks digitalization, there is not any reliable and simple tool to use.

To obtain a better understanding of the FIP network in samples, a new video analyzer of their structural parameters has been performed. AnimA has been developed to obtain rapidly a global mapping of the FIP and other microstructures in a section as a function of their azimuth and length. The originality of this program is not only to make it possible to digitize FIP but especially to allow the mapping at thin section scale for better representative studies. Another original possibility is to carry out measurements of dip in thick section.

Mapping FIP with AnimA

AnimA is developed on Visual Basic 6 and runs only under french versions of Microsoft Windows core 98 or NT4 and more recent. Total equipment is summarized with a microscope (Olympus BH2) coupled with a video camera (Olympus DP10), a motor-driven z stage, and an IBM PC.

The principal goal is to distinguish different structural elements of rocks. A lower magnification factor was therefore chosen (G*10) that insures to visually see the most part of the crack extensions. The specific *AnimA video screen method* (AVSM, P. Fractzak, UMR G2R) allows to digitalize the two extremities of each object and to determine their XY relative coordinates on the video screen plane (Figure 1). Then, each screen scene is saved as a jpeg format to reconstruct a total cartography of the thin section. A new scene is obtained with a manual XY translation of the section to insure a good continuity of images on the screen. The XY displacements are automatically determined. By this way, all of the XY data are referenced in the same base needed to finally map the entire thin section. Each observed object is labeled as a function of its type (F.I.P, microcrack). Their geometrical properties such as length and azimuth are automatically determined.

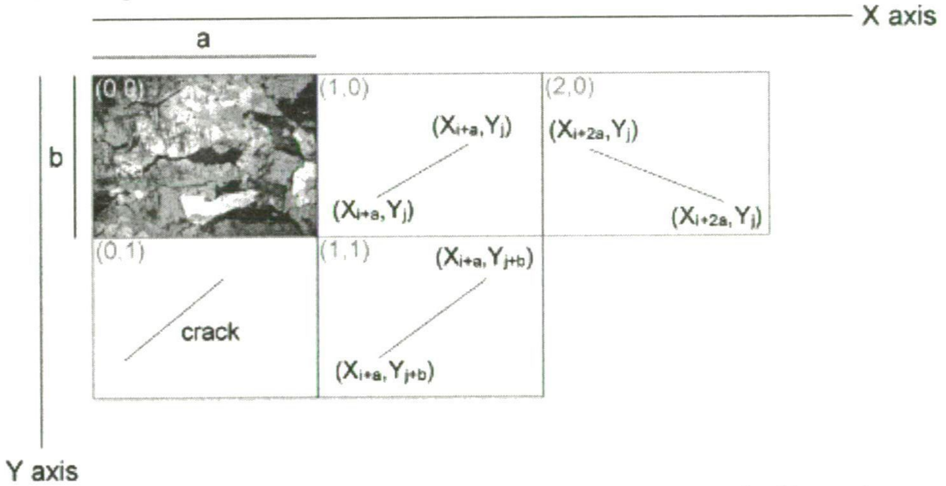

Figure 1: Procedure of XY translation used during the mapping of a thin section.

The AVSM calculates the position, length and azimuth of each crack in a section. The mapping of the cracks in the overall section gives a good appreciation concerning the crack density and the degree of failure anisotropy. AnimA also gives to user the length, the width and the surface of the studied section.

Statistics

Based on data obtained with AnimA (data can be exported as Excel file), different statistics on the FIP and other cracks repartition can be obtained. In figure 2, first image shows the entire thin section and the screenshots grid, second and third images show the networks for each type of fracture digitalized. Under these images, basic statistical treatments are presented.

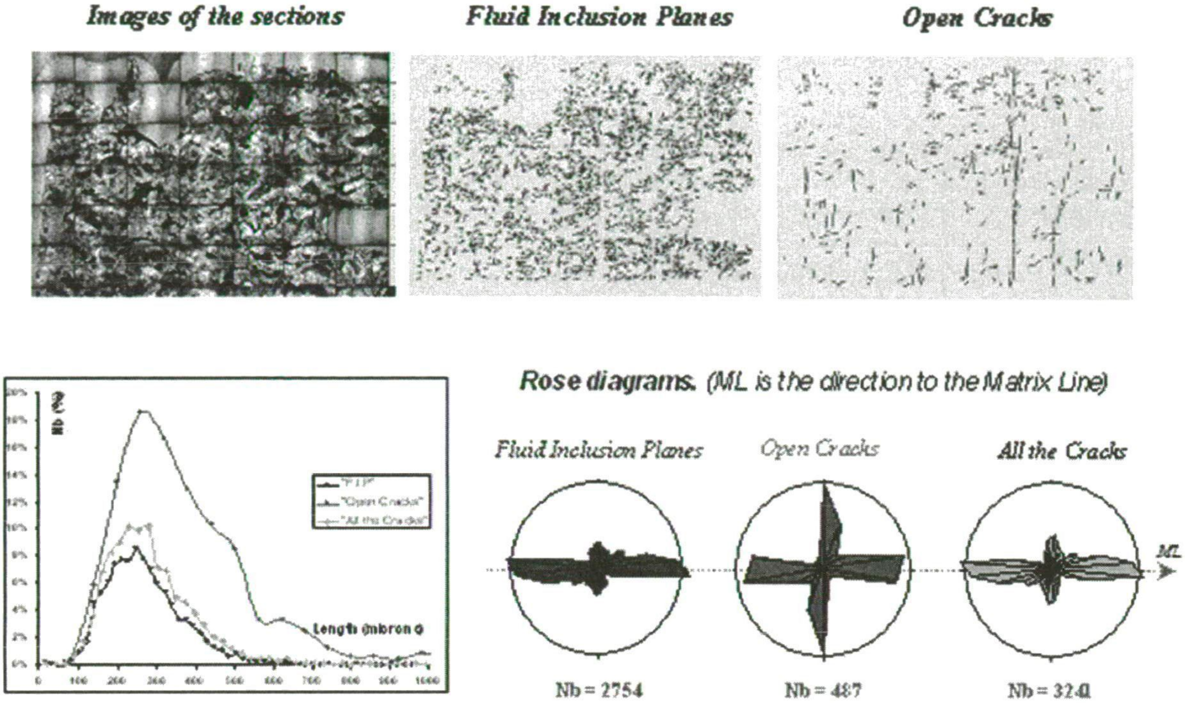

Figure 2: statistics after digitalization and mapping (data by M. LESPINASSE)

Conclusion

Some scientists have used this program (unpublished data from M.LESPINASSE) to compare results obtained by classical method, like universal stage. They have no significant difference between the two sets of data. At present time, the AnimA β version is stable. However we have to transcribe it on C++ or java for better compatibility with non-french MS Windows versions or with stations under Unix-Linux. We have also to improve this first version to introduce, for example, basic statistical treatments.

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