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C. K. Mawer

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C.K. Mawer
Department of Geology
University of New Brunswick
Fredericton, New Brunswick E3B 5A3

Present Address:
Department of Geology
University of New Mexico
Albuquerque, New Mexico 87131

Introduction

The term "mylonite" has had a chequered history. It was introduced by Lapworth (1885) to describe a rock-type found along planes of dislocation (thrusts) within the Moine Thrust Zone at Arnabol Hill, Eriboll, in northern Scotland. Since then, the term has been rather indiscriminantly applied to many different rock types, which apparently formed in many different geological environments by many different processes (e.g. Higgins, 1971; Zeck, 1974; Wiener, 1983). The term is commonly used by geologists for rocks formed within shear zones, though not always (e.g. Tullis *et al.*, 1982; White, 1982; Wise *et al.*, 1984; Mawer, 1985). It has been applied to rocks deformed by brittle (Higgins, 1971) or ductile (Bell and Etheridge, 1973) mechanisms, or some combination of the two (White and White, 1983). It is difficult to read any geological journal, and almost impossible to attend any geological conference, without seeing or hearing the word "mylonite" bandied about. Worse than that, many speakers and authors do not adequately describe what sort of rock *they* mean by "mylonite", or just what its implications are to them.

In an attempt to find out just what working structural geologists mean when they use the term "mylonite", a questionnaire was circulated at the October 1984 Canadian Tectonics Group meeting held in Maniwaki, Quebec. This questionnaire asked not only what a mylonite is, but what macro- to microstructural and petrographic criteria do geologists use when reaching their decision to name rock X a "mylonite". As expected, a wide range of opinions were received. Perhaps surprisingly, there was pronounced agreement on certain features.

The Questionnaire

Twenty-seven questionnaires were circulated, and twenty-three replies with comments were returned. The essential part of the mylonite questionnaire is reproduced below.

> *What is a mylonite*? Just *what* do we call a mylonite, and *what* criteria do we use to come to that decision? The term is bandied to and fro, and is applied to all manner of disparate rock-types. It seems to have a genetic connotation (since Lapworth's time, in fact), and this may or may not be good but appears to be unavoidable. But is it? So...what is a mylonite? How would we recognize one in the field, or in thin-section? What significance would we place on its discovery?
>
> Your assistance is sought. I would like everyone to define, in their own terms, "mylonite". The need for some sort of more-or-less strict definition is obvious, especially as the word seems to have a rather special and important genetic connotation.
>
> Readers with any comments about mylonites are invited to send them to me.

The Results

Grain size reduction. Seventeen definitions specified that mylonites are reduced in grain size relative to their host rocks, seven of these indicating that this grain size reduction is progressive, from host to mylonite. Eight of the seventeen further specified that crystallographic fabrics (i.e. patterns of crystallographic preferred orientation) are commonly developed in mylonites.

Zone of displacement and strong deformation. Fourteen definitions specified that mylonites occur in ductile fault zones or shear zones; that is, long, narrow, planar zones across which one block of rock has been displaced with respect to another without evidence of major loss of material continuity. Only one definition said that this was usually, but not always, the case. Nine definitions specified that mylonites were more strongly deformed or highly strained than the rocks surrounding them.

Mainly ductile deformation. Eleven definitions noted that mylonites developed by predominantly ductile deformation processes (crystal plasticity, dislocation and diffusion creep, dynamic recovery, etc.), though certain minerals, such as the feldspars, commonly deform by fracturing. Five of these definitions further specified that this deformation commonly involves (isochemical or non-isochemical) dynamic recrystallization.

Foliated, commonly lineated. Eleven definitions stated that mylonites are well-foliated or laminated, generally much more so than their host rocks. Three of these definitions stated that mylonites are usually strongly lineated, though not always.

Other diagnostic features. A number of definitions and comments contained examples of diagnostic features in addition to those mentioned above. Mylonites commonly contain deformed and/or rotated crystals which are larger than the mylonitic matrix (porphyroclasts and porphyroblasts - five definitions). Mylonites are cohesive rocks (four definitions). Mylonites commonly contain ribbon quartz grains (three definitions).

Other factors. Three definitions stated that mylonites can be developed in rocks that have any original composition and fabric. Three definitions mentioned that mylonite zones can be developed at any scale. Two definitions specified that mylonite should be used strictly as a field term. Only two definitions mentioned that the rock and its field associations should be examined and considered at all scales before *any* name is applied. Finally, only two respondents urged that speakers and authors describe and illustrate their mylonites in detail, at all scales.

Comments

The replies to the questionnaire showed that while some features are generally regarded as diagnostic of a mylonite, there is considerable divergence of opinion in details. In addition to the preceeding list of features, a number of "diagnostic" criteria were suggested only once, including such things as: mylonite has undergone a rapid strain rate; occurrence of microstructures with S-C geometry (see Lister and Snoke, 1984); mylonites are found in mylonite zones.

One respondent objected to the idea of science by consensus. However, as authors do not seem willing to fully describe their material (in this case, mylonites), some sort of consensual definition seems necessary, at least as a first approximation which can then be made more specific. Based on the replies to my questionnaire, such a definition can be tendered:

> *mylonite* — mylonites occur in shear zones, that is, zones across which one block of rock is displaced with respect to another, and which show no evidence of major loss of material continuity. They develop primarily by ductile deformation processes. They are well-foliated and commonly well-lineated, and show an overall reduction in grain size when compared to their hosts. Mylonites commonly contain a suite of diagnostic asymmetric structures, such as rotated porphyroclasts/blasts and S-C textures. Mylonite zones can be developed at any scale, in rocks of any original composition and fabric.

Finally, though not apparently majority opinions (unless most respondents thought these two points self-evident), the rock and its field associations must be examined and considered at all scales, and the rocks must be fully described and illustrated at all scales.

This is, after all, the basis of any good petrography.

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