Tectonophysics, 67 (1980) 221—249
Elsevier Scientific Publishing Company, Amsterdam — Printed in The Netherlands

PETROGENESIS OF CATACLASTIC ROCKS WITHIN THE SAN ANDREAS FAULT ZONE OF SOUTHERN CALIFORNIA, U.S.A.

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(Received May 23, 1979; revised version accepted August, 1979)

ABSTRACT

Anderson, J.L., Osborne, R.H. and Palmer, D.F., 1980. Petrogenesis of cataclastic rocks within the San Andreas fault zone of southern California, U.S.A. Tectonophysics, 67: 221—249.

This paper petrologically characterizes cataclastic rocks derived from four sites within the San Andreas fault zone of southern California. In this area, the fault traverses an extensive plutonic and metamorphic terrane and the principal cataclastic rock formed at these upper crustal levels is unindurated gouge derived from a range of crystalline rocks including diorite, tonalite, granite, aplite, and pegmatite.

The mineralogical nature of this gouge is decidedly different from the "clay gouge" reported by Wu (1975) for central California and is essentially a rock flour with a quartz, feldspar, biotite, chlorite, amphibole, epidote and oxide mineralogy representing the milled-down equivalent of the original rock. Clay development is minor (less than 4 wt. %) to nonexistent and is exclusively kaolinite. Alterations involve hematitic oxidation, chlorite alteration on biotite and amphibole, and local introduction of calcite. Electron microprobe analysis showed that in general the major minerals were not reequilibrated with the pressure—temperature regime imposed during cataclasis.

Petrochemically, the form of cataclasis that we have investigated is largely an isochemical process. Some hydration occurs but the maximum amount is less than 2.2% added H_2O. Study of a 375 m deep core from a tonalite pluton adjacent to the fault showed that for Si, Al, Ti, Fe, Mg, Mn, K, Na, Li, Rb, and Ba, no leaching and/or enrichment occurred. Several samples experienced a depletion in Sr during cataclasis while lesser number had an enrichment of Ca (result of calcite veining).

Texturally, the fault gouge is not dominated by clay-size material but consists largely of silt and fine sand-sized particles. An intriguing aspect of our work on the drill core is a general decrease in particulate size with depth (and confining pressure) with the predominate shifting sequentially from fine sand to silt-size material.

The original fabric of these rocks is commonly not disrupted during the cataclasis. It is evident that the gouge development in these primarily igneous crystalline terranes is largely an *in situ* process with minimal mixing of rock types. Fabric analyses reveal that brecciation (shattering), not shearing, is the major deformational mechanism at these upper crustal levels.

0040-1951/80/0000—0000/$02.25