C Kimberlites: how ? why ?

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MINERALOGICAL AND TEXTURAL-GENETIC CLASSIFICATION OF KIMBERLITES IN NORTHERN COLORADO AND SOUTHERN WYOMING, U.S.A.

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Accurate comparisons between kimberlites from different world-wide localities commonly are difficult to establish from the literature because no unified scheme of classification has been utilized. Mineralogical and textural-genetic classifications recently were developed by Skinner and Clement (1979) and Clement and Skinner (1979) in an effort to correct previous deficiencies in nomenclature. These classifications have been combined into a descriptive terminology scheme that is being applied to North American kimberlites (McCallum, 1981). Most Colorado-Wyoming kimberlites are phlogopite, calcite, serpentine, varieties, but opaque mineral, diopside, or perovskite rich types are abundant at some localities. Carbonatized kimberlite is common and silicified phases occur locally. All varieties are classified as diatreme and hypabyssal facies, any crater facies having been removed by erosion. Diatreme facies consist of tuffisitic kimberlite and tuffisitic kimberlite breccia with microlitic, and crystallinoclastic and segregationary textures. Autolithic types are abundant in some pipes and commonly reflect substantial compositional differences from host phases. Hypabyssal facies include both aphanitic and microporphyritic kimberlite and kimberlite breccia. Segregationary textures are common, and a pronounced flow layering is present locally. Wall rock breccia containing minor amounts of kimberlitic components occurs adjacent to several pipes and is characteristic of the hypabyssal or "root zone" facies. Names of specific kimberlite phases are established primarily on texture, and dominant matrix minerals are included as modifiers (e.g. tuffisitic calcite kimberlite breccia). (Study supported, in part, by Earth Sciences Section of NSF, Contract EAR-7810775)

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KIMBERLITE TEXTURES I

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The occurrence of hypabyssal- and diatreme-facies kimberlites in kimberlite pipes has long been recognized. In this contribution, the first of two companion papers, the range of textures exhibited by hypabyssal-facies kimberlites is described and the origins of the different textures are evaluated.

Particular attention is paid to the genesis of a variety of segregationary textures. The irregular to globular segregations in these rocks are commonly composed of the volatile-rich, late-crystallizing components of the kimberlites but relatively high temperature, anhydrous minerals also occasionally occur in segregations. Volatile-rich segregations are ascribed to a variety of causes; some are interpreted as segregation vesicles (gas cavities filled by residual liquids) and others are regarded as direct segregations of melt. Most are, however, ascribed to condensation of gas-rich exsolved volatiles following varying degrees of vesiculation under conditions where the escape of the exsolved fractions was inhibited. The possibility that some segregations may relate to carbonate-silicate or silicate liquid immiscibility is examined.

The textures of rocks which are intermediate in character between hypabyssal- and diatreme-facies kimberlites are also described and their modes of origin assessed.

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KIMBERLITE TEXTURES II

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In this contribution, the second of two companion papers, the range of textures exhibited by diatreme-facies kimberlites is described and their petrogenesis is discussed.

Emphasis is placed on the pelletal textures which are characteristic of many tuffisitic kimberlite breccias. These textures reflect the occurrence of abundant pelletal lapilli which display a variety of internal and morphological features. Variations in the character of lapilli are evaluated in terms of an evolutionary scheme which incorporates an assessment of the degrees to which lapilli are formed prior to, or during, vapour-solid fluidization events which were triggered by explosive breakthrough to surface. Modifications of the lapilli by deuteric alteration or