mineralogically similar and classification as macroporphyritic and aphanitic-hypabyssal facies, ilmenite-rich phlogopite kimberlites would be appropriate. The mineralogical similarities of the two textural types of kimberlite are reflected in similar bulk rock compositions, although minor trace element differences are noted. In addition to a geochemical examination of the major xenocrysts, the relationships between the dominant matrix minerals have also been investigated. Of particular interest is the presence of chromian-rich ilmenite inclusions in olivine and occasionally phlogopite phenocrysts. Mantle xenoliths comprising phlogopite-ilmenite assemblages and clinopyroxene-ilmenite intergrowths are observed, though rarely. The mineral chemistry of these xenoliths has been documented and will be compared with examples from other kimberlites. From the petrographic and geochemical investigations the two textural varieties of kimberlite are apparently related, possibly through filter pressing processes and/or multiple intrusion.

B6

DIAMONDIFEROUS KIMBERLITES AT ORROROO, SOUTH AUSTRALIA

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A suite of Jurassic dykes and associated blows ranging in thickness from a few millimetres to 30 metres occur near Orroroo, South Australia. All the intrusions at surface are extensively altered but most of them are apparently petrographically similar and can be identified as altered phlogopite-rich kimberlites. Fresh material was obtained from one of the dykes at 60 metres depth. This borehole core can be classified as a hypabyssal, calcite, phlogopite kimberlite. Mineral chemistry of olivine and groundmass phlogopite, tetraferriphlogopite rims, serpentine, perovskite, spinel and clinopyroxene are characteristic of kimberlites. Whole-rock geochemistry of this dyke is also typical of such mineralogical varieties of kimberlite.

The kimberlite dykes can be divided into three main geographic groups each falling on a different, but sub-parallel, strike line. Variations in the nature of the heavy mineral concentrate and diamond content correlates with this grouping. Together with the petrography, this suggests that the dykes were intruded as three separate, but related pulses. Although no ultramafic xenoliths were found, the chemistry of garnets, ilmenites, diopsides and spinels is discussed.

Details of the shape and colour of the diamonds recovered from the kimberlites are given. Enstatite and magnesio-wustite occur as inclusions in the diamonds.

B7

THE PETROLOGY OF OLIVINE MELILITITES FROM NATAL, SOUTH AFRICA

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Six new occurrences of olivine melilitites have been discovered on the East Coast of South Africa. These occur as small pipes and dykes in north central Natal. They are important as they are the first recorded occurrences of alkaline ultrabasic magmatism in this area. The rocks intrude sediments of the Karoo and Cape Supergroups. The occurrences are mineralogically similar to those found on the West Coast (Moore 1979).

Petrographically both diatreme facies and hypabyssal facies textures are recognized. The diatreme facies rocks consists of varying proportions of country rock fragments, rounded 'pellets' and earlier generation fragments of olivine melilitite and phlogopite phenocrysts set in an extremely fine-grained matrix of rare clinopyroxene microlites, secondary clay minerals and cryptocrystalline carbonate. The earlier generation fragments are extensively altered but relicts of olivine, melilite, perovskite, phlogopite and small spinels can be recognized. These are set in a base of secondary clay minerals and lesser cryptocrystalline carbonate.

The hypabyssal olivine melilitites are porphyritic rocks. They consist of phenocrysts of altered olivine and minor augite, phlogopite and ilmenite in a finer grained groundmass. This consists of altered melilite, phlogopite, diopside, apatite, spinels and perovskite set in a base of serpentine and minor calcite.

These rocks are similar to kimberlites in several respect i.e. their mode of emplacement, textures and to a limited extent their mineralogy.

B8

THE 1977 EXPLOSIVE ERUPTIONS OF THE UKINREK MAARS, ALASKA

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In March/April 1977 the two small Ukinrek maars formed on the Aleutian Range when weakly undersaturated alkali olivin basalt magma rose 13 km behind the Andesite volcanic chain. During the volcanic activity eruption clouds rose to heights of up to 6500 m.

The West Maar formed within 3 days and reached a diameter of 170 m and a depth of 35 m. Its activity started with near-surface explosions leading to ejection of large partially frozen (permafrost) moraines and conglomerates and intermittant lava fountaining. After a maar forming collapse the level of explosions retreated to deeper levels which caused ejection of blocks of the dike feeding the initial eruptions.

The East Maar formed during the following 6 days. The maar reached a diameter of 300 m and a depth of 70 m. During the eruptions frequently two styles of activity could be observed simultaneously within the maar: phreatomagmatic eruptions next to lava fountaining. Whereas the phreatomagmatic produced juvenile lapilli and bombs of relatively low vesicularity of round to cauliflower shape, as well as large amounts of wall rock fragments, the lava fountains caused formation of scoriaceous fragments.

The tuff wall therefore consists of a sequence of interlayered phreatomagmatic deposits and scoria beds.
The phreatomagmatically formed pyroclastic beds show many characteristic features observed also in the deposits of other alkali basaltic maars.

Kienle, J.,Kyle, P.R., Self, S., Motyka, R.M. &Lorenz, V., 1980:Ukinrek maars, Alaska, I. April 1977 eruption sequence, petrology and tectonic setting.- J. Volcanol. Geothermal Res., 7, 11-37.

B9

EXPLOSIVE VOLCANISM OF THE WESTEIFEL VOCANIC FIELD/GERMANY

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The Quarternary volcanic field of the West Eifel is located on the presently rising Rhenish Massif above an anomalous upper mantle structure. Magmas of nephelinitic, leuzitic, basanitic, phonolitic, and tephritic composition reached the surface in about 240 volcanic structures. About 60 maars are known in this classic maar region. The remaining 180 volcanoes consist mostly of scoria cones.

Nearly all maars formed within valleys. Abundant groundwater circulating within zones of structural weakness underneath the valley floors had access to the rising magma usually during the whole period of the phreatomagmatic maar eruptions. In contrast most of the scoria cones formed on hills and valley slopes through the process of lava fountaining. Many of these scoria cones, however, erupted within small maars (initial maars). The magma rising underneath these volcanoes, therefore, must have contacted in near surface levels only limited amounts of ground water circulating in hydraulically less active zones of structural weakness. When the available water had been used up during the resulting initial maar forming phreatomagmatic eruptions the magma could rise, intrude the diatreme, and erupt on the maar floor forming a scoria cone in a second eruptive phase.

The hydrogeological situation which in the Eifel is characterized by zones of structural weekness of different hydraulic activity thus clearly controls formation of the various West Eifel volcano types: maars, scoria cones and scoria cones with initial maars.

Lorenz,V. & Büchel, G., 1980: Zur Vulkanologie der Maare und Schlackenkegel der Westeifel.- Mitt. Pollichia, 68, 29-100

B10

FRAGMENTATION OF ALKALI-BASALTIC MAGMAS AND WALL-ROCKS BY EXPLOSIVE VOLCANISM

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In the Eifel/W-Germany explosive volcanism gave rise to formation of maars. The juvenile pyroclasts of the maar deposits are typically poor in vesicle content, usually of round to cauliflower shape, and characterized by enclosed small wall-rock xenoliths.

These characteristics require intensive fragmentation and chilling of a vesicle poor magma, action of surface tension on the magma fragments once they had formed, and coalescence of magma fragments around wall-rock fragments which therefore became enclosed in the juvenile lapilli and bombs.

Internal concentric layering of lapilli and bombs implies liquid accretion of melt fragments around quasi-solid round juvenile clasts formed earlier.

The large proportion of wall-rock derived xenoliths in the pyroclastic deposits (up to 95 %) requires explosions which not only fragmented the magma intensively but also the wall-rocks of the explosion site. These phenomena especially the intensive fragmentation of the wall-rocks are believed to be explained by phreatomagmatic explosions only.

B11

A PROPOS DES DIATREMES ET DU PHREATOMAGMATISME : LE TERME "PEPERITE" DOIT-IL ÊTRE CONSERVÉ ?

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Les pépérites sont les roches les plus célèbres de la Limagne (Auvergne,France). Elles doivent leur nom a la présence de granules de lave vitreuse ("en grains de poivre") emballés dans une matrice habituellement marneuse. Leur genèse a fait l'objet d'une controverse qui a duré plus d'un siècle entre les partisans d'une origine volcanique sous-lacustre (Scrope,1827,1866) et ceux d'une origine intrusive, aux épontes de filons basaltiques postérieurs à la sédimentation oligocène (Dufrénoy,1830;Michel Lévy,1890). A la suite des travaux de Michel (1953) les premiers l'emportérent et un consensus s'établit pour admettre que "les pépérites sont ( ) des roches formées par intrusion, émiettement et mélange d'une lave ( ) dans les sédiments encore plastiques des lacs du Stampien supérieur". Il s'agissait donc d'une variété de hyaloclastites - au sens originel de Rittmann - nécessairement contemporaines des lacs oligocènes. C'est cette interprétation que l'on trouve dans les traités modernes, français cu étrangers. Elle doit maintenant être définitivement abandonnée.

Les travaux clermontois récents - inédits pour la plupart - aboutissent aux résultats suivants:

dynamisme. Les pépérites sont des tufs (tufs de lapillis habituellement, plus rarement tufs cendreux) phréatomagmatiques aériens. Leur dépôt s'est fait sous forme de retombées aériennes ou de déferlantes basales. L'eau provoquant la fragmentation et la trempe du matériel volcanique et le dynamisme explosif provient des nappes aquiféres, toujours présentes dans le bassin sédimentaire. La matrice "sédimentaire" est formée de "cendre" où les produits juvéniles sont subordonnés aux produits marneux. Certains niveaux sont de véritables "marnes reconstituées" où seuls des lapillis accrétionnés peuvent, macroscopiquement, attester du caractère volcanique; leur interstratification explique l'age oligocéne attribué antérieurement aux pépérites.

structures. Il s'agit de diatrèmes (environ une centaine[1]) recoupant la totalité des couches oligocénes: les calcaires construits à Phryganes, les plus récents, se retrouvent en blocs dans les pépérites ou en panneaux descendus en bordure des structures (ex. Jussat, Hubel, etc.). Les tufs lités du remplissage ont toujours un pendage interne, donnant une disposition "en pile d'assiettes". La cheminée, brèchique, est le plus souvent centrale, mais peut se trouver aussi en bordure (Montaudou). Des dykes basaltiques tardifs peuvent recouper le diatrème, s'injecter le long de la faille bordière ou même dans l'encaissant (sill du Puy Mardoux).

appareils externes. La faible résistance des marnes à l'érosion n'a pas permis leur conservation. Par contre la dépression sommitale est préservée dans de nombreux cas: il s'agit d'un maar ou d'un cratère en entonnoir, élargi par glissement de panneaux de l'anneau de tufs ou de l'encaissant sédimentaire pour les plus grandes structures (Gergovie). Cette dépression est remplie de sédiments détritiques, chimiques ou organiques, et/ou de produits volcaniques banals (lac de lave ou cône de scories); grâce à l'inversion de relief, ces remplissages forment l'essentiel des reliefs de la Limagne de Clermont et de la Comté d'Auvergne.

âge des pépérites. Toutes les structures pépéritiques actuellement datées paléontolcgiquement ou géochronologiquement sont miocènes. D'autres pourraient être plus jeunes, mais aucune ne semble pouvoir, géologiquement, être oligocène.

conclusion. Génétiquement, les pépérites sont des tufs lités ou massifs comparables à beaucoup d'autres tufs résultant d'une activité phréatomagmatique. Leur originalité vient du mélange intime des petits granules basaltiques et de la matrice cendreuse d'origine sédimentaire, qui donne à la roche un cachet particulier. C'est la nature des roches traversées (marnes) et la profondeur des nappes aquifères en Limagne qui a permis un brassage aussi efficace dans les systémes fluidifiés à l'origine de ce volcanisme.

Nous proposons de conserver le terme "pépérite" comme un terme de faciès.