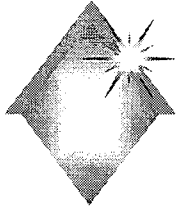


C.6. Alkaline Drainage Chemistry of Kimberlite Deposits

by
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Alkaline Drainage Chemistry of Kimberlite Deposits

Diane Howe
BC Energy and Mines, Mines Branch

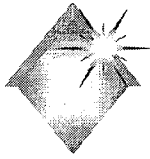
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Introduction...

- what is a kimberlite?
- what the problem(s)/ concerns were
- testwork conducted and results
- conclusions

2

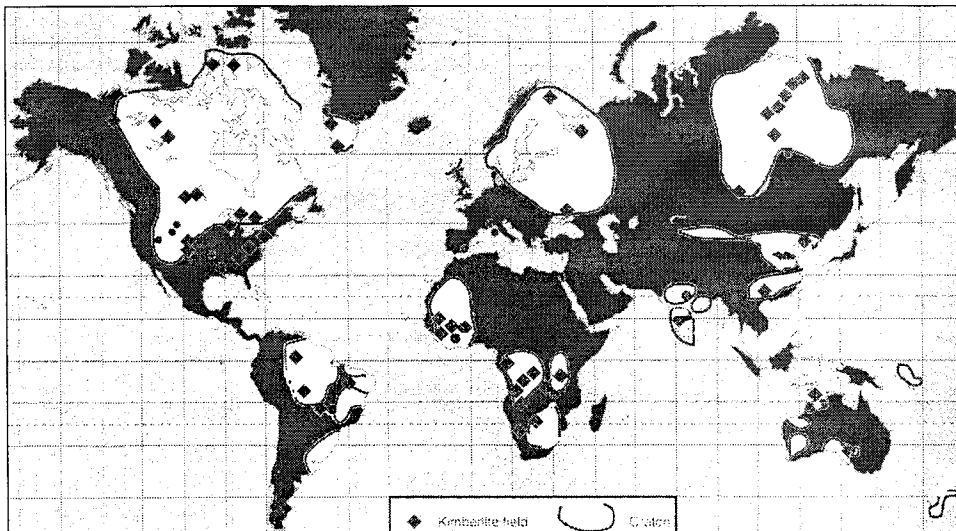


Kimberlites...



- what are they?
- where do they come from?
- theories on where and how they are emplaced?
- mineralogical and chemical characteristics

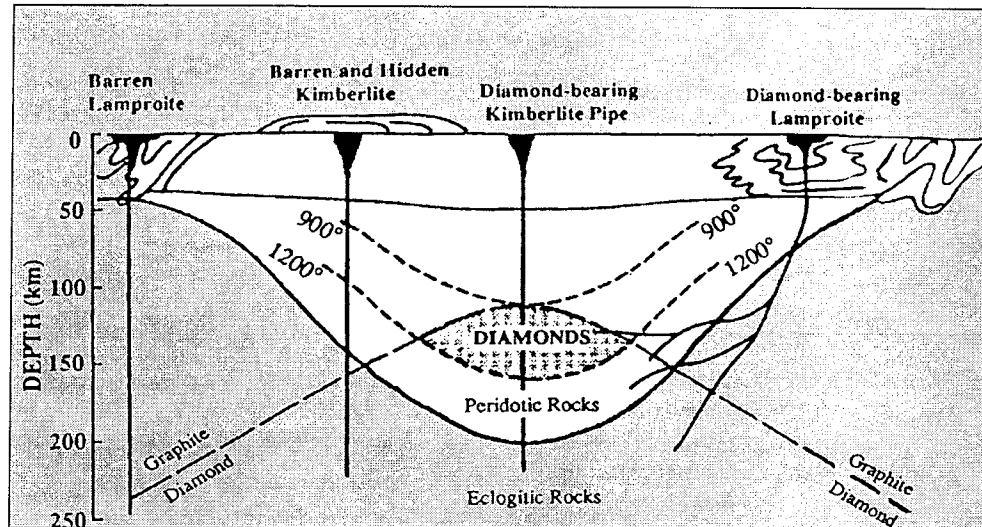
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Where are they found...

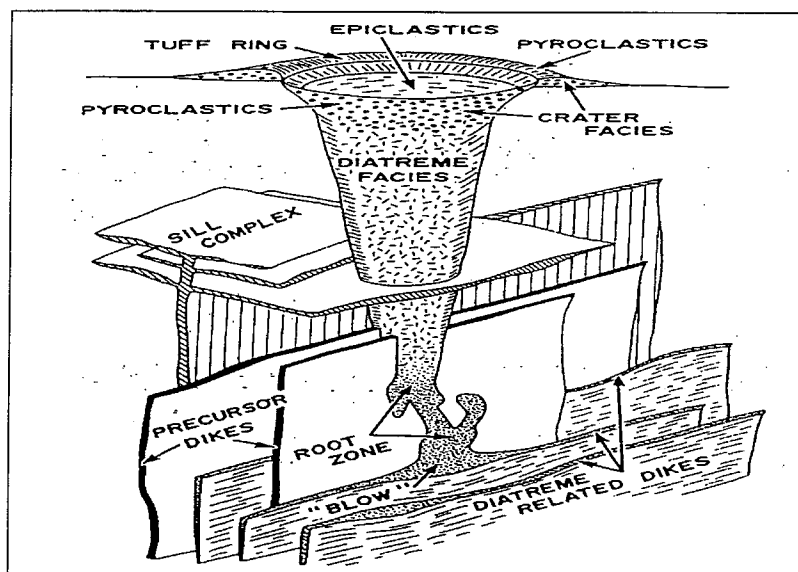
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Kimberlites serve as vehicles of transport...



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Emplacement and morphology...



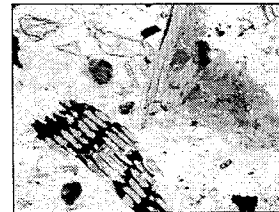
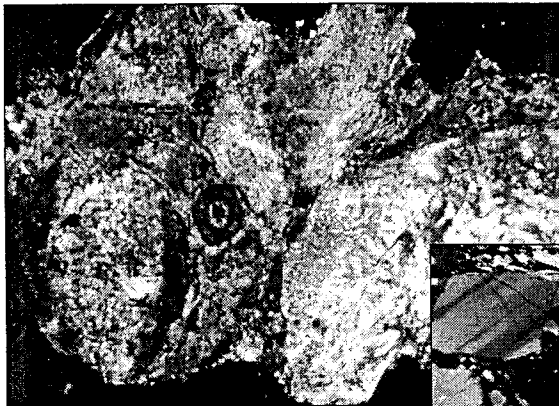
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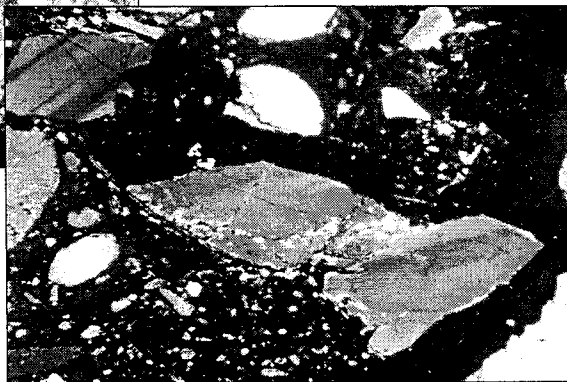
Definition:

"kimberlites are a group of volatile rich, potassic ultrabasic rocks which commonly exhibit inequigranular texture resulting from the presence of macrocrysts (in some cases megacryst) set in a fine grained matrix. The mega/macrocryst assemblage consists of anhedral crystals of olivine, magnesium, ilmenite, Cr poor titanium pyrope, Cr poor diopside, phlogopite, enstatite and Ti poor chromite. The matrix contains a second generation of olivine which occurs together with one or more of the following primary minerals; monticellite, phlogopite, pervoskite, spinel, apatite and serpentine." (Mitchell, 1995)

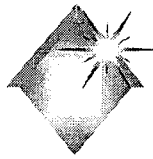
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crystalline forms... intense
alteration... wood fragment
?



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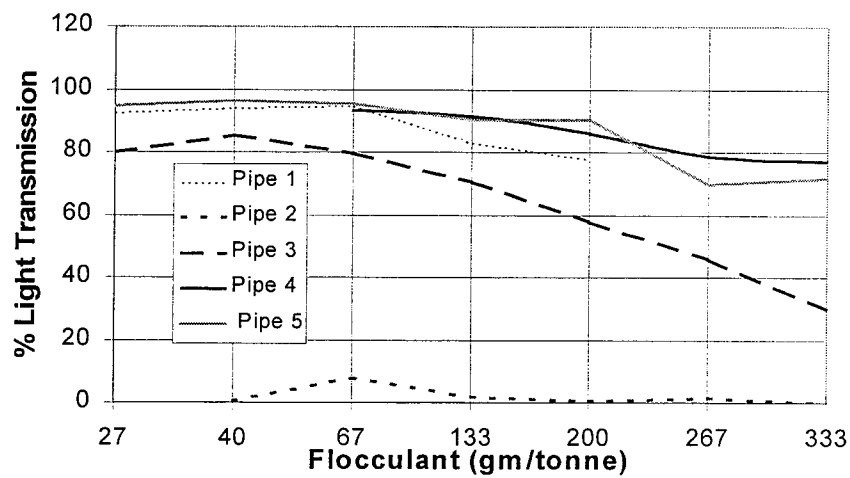


Geochemical Composition...

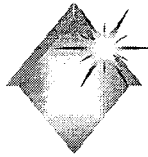
Oxide Component	Diorite Intrusive	Kimberlite
SiO ₂	72.1%	32.1%
Al ₂ O ₃	13.9%	2.6%
Fe ₂ O ₃	0.9%	9.2%
MgO	0.5%	28.5%
CaO	1.3%	8.2%

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Flocculation testwork on the Lac De Gras kimberlites



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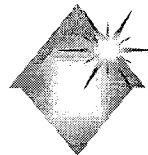


Questions?

- why did each kimberlite pipe react differently to the various types of flocculant?
- what was causing the alkaline pH?



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Test work conducted...

- mineralogy
 - thin sections, XRD, SEM
- physical characteristics
 - particle size, surface area, zeta potential
- chemical and metal leaching characteristics
 - CEC, XRF, ICP, shake flask, olivine dissolution test
- flocculation and coagulation testing

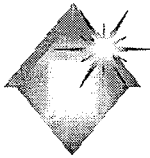
12



Metal leaching characteristics...

- shake flask test
 - using pH solutions of 7, 9, and 11
- olivine dissolution test

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Shake flask test work...

- magnesium and calcium were the major cations in solution
- not all pipes released these cations in the same quantities

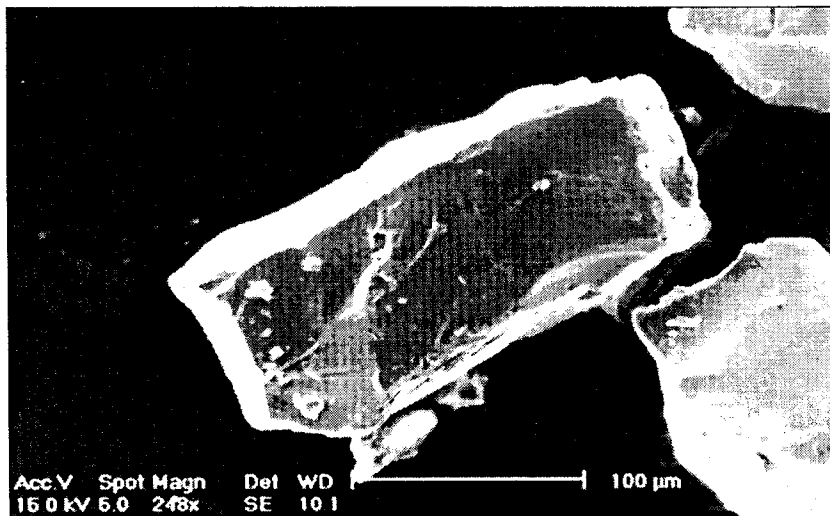
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Olivine dissolution test...

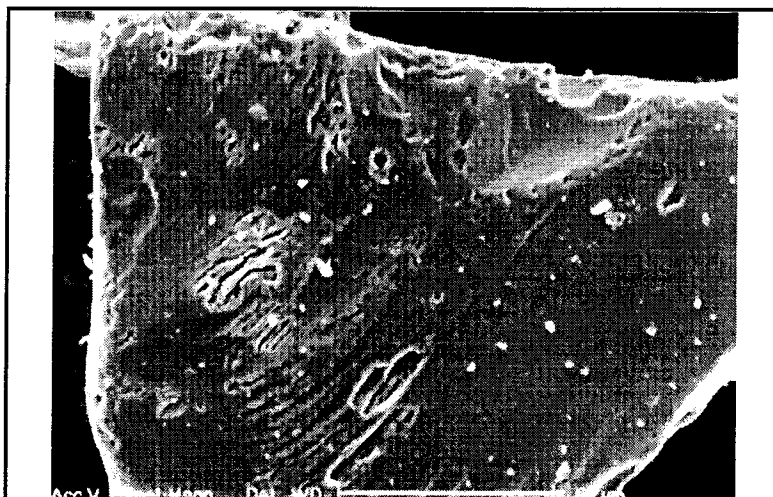
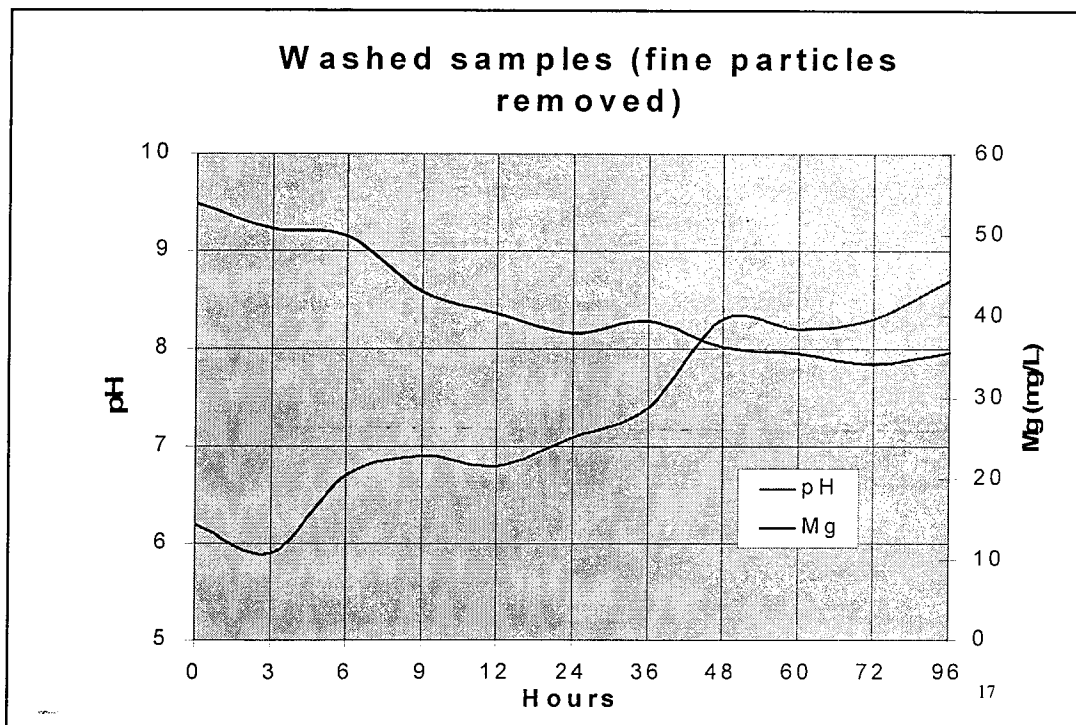
- olivine comprised between 40 to 80% of the samples
- mineralogical studies indicated minimal carbonate present
- likely looking at a form of hydroxide

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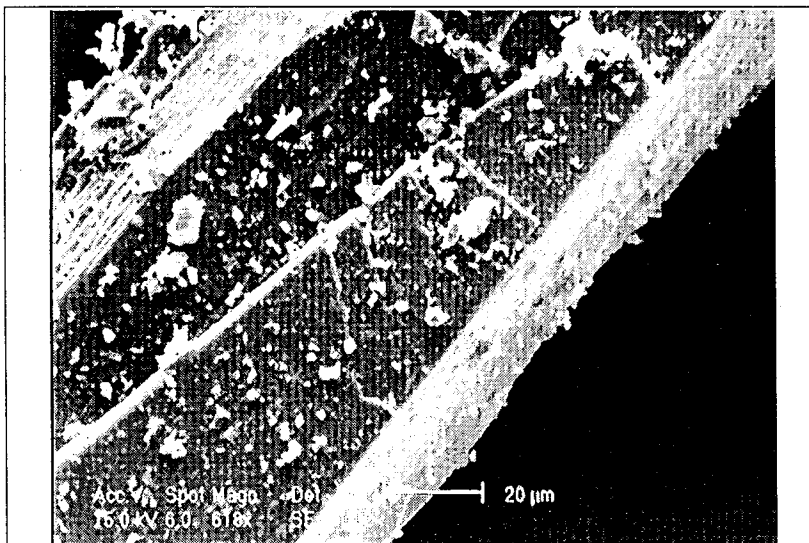


Olivine rinsed of fine particles

16



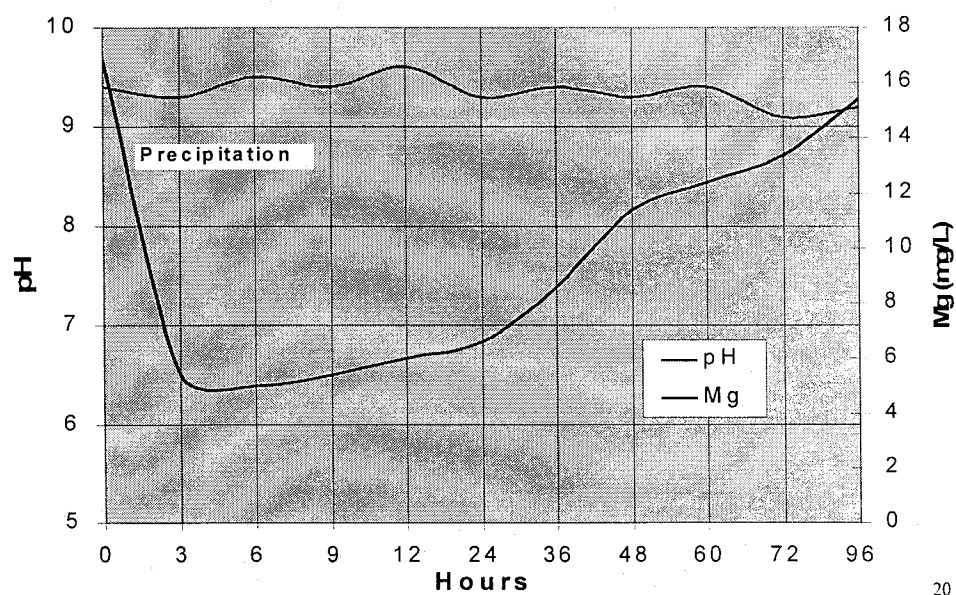
Olivine after 96 hrs in distilled water



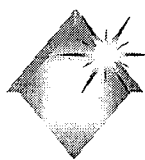
Olivine with adhering fine particles

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Unwashed samples (fine particles left)



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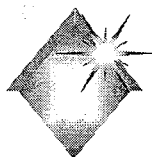


What was causing the Alkaline pH...?

- pHs < 10 solutions of MgOH?
- pHs > 10 dilute solutions of CaOH?



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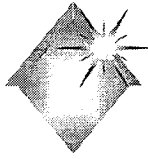


Results...

Understanding the process...

The type and amount of flocculant and/or coagulant preferred, depends on the cations (Mg and/or Ca) available in solution, which in turn is a function of the pH which is dependent on the mineralogy.

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Conclusions...

Know your mineralogy !

D. EFFECTS OF MINING ON NATURAL
WATER BODIES

