ormulae which can obscure
n be placed in the view that
$Al)O_4$ tetrahedra is virtually
ven, is commonly a multiple
recise chemical, X-ray and
its on the basis of this ideal
for a large number of zeolite
: Al ratio than to variations
se exchange effects and are
Nevertheless as the various
nto their lattices to varying
onments of formation must
the barium zeolites are not

n of certain zeolites not only
; and (ii) Na_2 for Ca, or more
tution: (iii) Al for Si within
$K, Ca_{\frac{1}{2}})$ occupying otherwise
nber of W group cations per
r two types of replacement.
ies are listed below together
ns listed. Specific gravity is
are analcime and wairakite),
The values given have been
minations and in some cases
nces have been cited; many

in molecular proportions on
$Na_2, K_2)O$ being numerically
s anorthite. Horizontal lines
ough each series. Prehnite,
n these the Al_2O_3 content is
as been plotted arbitrarily at
d structural data. In several
analyses of apparently good
ighly reactive and unstable
e of metastable compositions

with minor substitution of
rtwig, 1928; Coombs, 1955);
analcimes may range from
d $Z = 24$ respectively.
y and Bannister, 1933).
$l_{13\cdot5}Si_{22\cdot5}O_{72}.36{\cdot}H_2O$. Alkalis
$_2O$; $Z = 6$; $D = 2{\cdot}082$.
H_2O; $Z = 3$. In eight out
5·7 to 16·3 H_2O per unit cell,
unit cell, which would make
ith the approximate range
; D typically 2·25 ± 0·03.

turally related to epistilbite.

7 (Staples and Gard, 1958).
$D = 1{\cdot}92$ (cf. Strunz, 1955).

Gismondine. $CaAl_2Si_2O_8.4H_2O$; $Z = 8$ (Kraus, 1939) to $Ca_{0\cdot92}Al_{1\cdot84}Si_{2\cdot16}O_8.4H_2O$ with moderate substitution of $(K,Na)_2$ for Ca.

Gmelinite. According to Strunz (1956), polymorphous with Na-rich chabazite, and often containing chabazite in lamellar intergrowth; $(Na_2,Ca)Al_2Si_4O_{12}.6H_2O$; $Z = 4$; $D = 2{\cdot}028$.

Gonnardite. Polymorphous with thomsonite and mostly near $(Ca,Na_2)_{4\cdot3}Al_{8\cdot6}Si_{11\cdot4}O_{40}.12H_2O$ (Meixner *et al.*, 1956) but can also have higher ratios of Al:Si (Mason, 1957). $D = 2{\cdot}27 \pm 0{\cdot}02$.

Heulandite. Normally in the range $(Ca,Na_2)_{4\cdot8}Al_{9\cdot6}Si_{26\cdot4}O_{72}.24H_2O$; $D = 2{\cdot}21 \pm 0{\cdot}03$; to $(Ca,Na_2)_4Al_8Si_{28}O_{72}.24H_2O$; $D = 2{\cdot}18 \pm 0{\cdot}03$. There is often appreciable K and/or Sr. In the silica-rich variety clinoptilolite, the composition approaches $Ca(Na,K)_4Al_6Si_{30}O_{72}.24\ H_2O$; $D = 2{\cdot}14 \pm 0{\cdot}03$.

Laumontite. $Ca_{4\cdot25}Al_{8\cdot5}Si_{15\cdot5}O_{48}.16H_2O$ to $Ca_{3\cdot75}Al_{7\cdot5}Si_{16\cdot5}O_{48}.16H_2O$ with minor replacement of Ca by Na_2, i.e. near $CaAl_2Si_4O_{12}.4H_2O$; $Z = 4$; $D = 2{\cdot}29 \pm 0{\cdot}02$ (Coombs, 1952). Leonhardite is a partially dehydrated variety with about 14 H_2O.

Levyne. Perhaps $CaAl_2Si_4O_{12}.5H_2O$ to $Ca_{1\cdot1}Al_{2\cdot2}Si_{3\cdot8}O_{12}.5H_2O$ with moderate replacement of Ca by $(Na,K)_2$. Strunz (1956) suggests polymorphous and structural relationships with chabazite and gives 6 H_2O; $Z = 9$; $D = 2{\cdot}140$. The few available analyses appear to indicate 5 H_2O rather than 6 H_2O.

Mesolite. Essentially $Na_2Ca_2Al_6Si_9O_{30}.8H_2O$; $Z = 8$; $D = 2{\cdot}26$; minor Na_2 for Ca (Hey, 1933).

Metascolecite. Higher temperature polymorph of scolecite (Hey, 1936).

Mordenite (*ptilolite*). $(Na_2,K_2,Ca)Al_2Si_{10}O_{24}.7H_2O$; $Z = 8$ (e.g. Waymouth *et al.*, 1938). with alkalis usually dominant over Ca. $D = 2{\cdot}12 \pm 0{\cdot}03$. First-class analyses (as defined by Hey, 1932a) show variations of no more than 0·15 Al and Si. Synthetic mordenites range from pure Ca to pure Na members (Barrer, 1948 and Appendix 1 of this paper).

Natrolite. $Na_2Al_2Si_3O_{10}.2H_2O$; $Z = 8$; $D = 2{\cdot}24$. Up to 1 in 16 Na replaced by K and 1 in 4 Na replaced by $Ca_{\frac{1}{2}}$ (Hey, 1932b).

Phillipsite. $(Ca,K_2)_{2\cdot5}Al_5Si_{11}O_{32}.12H_2O$ to $(Ca,K_2)_{3\cdot5}Al_7Si_9O_{32}.12H_2O$ with Na usually subordinate (cf. Wyart and Chatelain, 1938). $D = 2{\cdot}20 \pm 0{\cdot}02$ for typical intermediate members of the series.

?*Pseudonatrolite.* Near $(Ca,Na_2)Al_2Si_6O_{16}.5H_2O$ (Hey, 1955, p. 162).

Scolecite. $CaAl_2Si_3O_{10}.3H_2O$; $Z = 8$; $D = 2{\cdot}27 \pm 0{\cdot}02$. Minor Na_2 for Ca (Hey, 1936).

Stilbite. Approximately $(Ca,Na_2)_4Al_8Si_{28}O_{72}.28H_2O$; $D = 2{\cdot}15 \pm 0{\cdot}02$; to $(Ca,Na_2)_5Al_{10}Si_{26}O_{72}.28H_2O$; $D = 2{\cdot}18 \pm 0{\cdot}02$ (cf. Sekanina and Wyart, 1936). The average water per unit cell for some two dozen representative analyses is 28·7 H_2O as against 24·2 for heulandite. The suggestion of Strunz and Tennyson (1956) that a correct formula should show 24 H_2O as in heulandite and that the two minerals are polymorphs as well as having related (though different) structures, is not therefore accepted.

Thomsonite. $(Ca,Na_2)_{8\cdot4}Al_{16\cdot8}Si_{23\cdot2}O_{80}.24H_2O$; $D \fallingdotseq 2{\cdot}30$ to $(Ca,Na_2)_{10\cdot25}Al_{20\cdot5}Si_{19\cdot5}O_{80}.24H_2O$; $D \fallingdotseq 2{\cdot}38$ (Hey, 1932a). $CaAl_2Si_2O_8.2{\cdot}4H_2O$; $Z = 10$; $D \fallingdotseq 2{\cdot}37$, is a possible synthetic member (Goldsmith, 1952).

Wairakite. $CaAl_2Si_4O_{12}.2H_2O$; $Z = 8$; $Z = 2{\cdot}265$ (Steiner, 1955; Coombs, 1955).

Yugawaralite· Unit cell contents calculated from the data of Sakurai and Hayashi (1952) are approximately $Ca_{3\cdot84}(Na,K)_{0\cdot34}Al_{7\cdot55}Si_{21\cdot33}O_{58}{\cdot}15{\cdot}3H_2O$, corresponding roughly to $4CaAl_2Si_5O_{14}.4H_2O$. $D = 2{\cdot}20$.

Appendix 3

Chemical and Physical Data on Heulandite and Prehnite

(A. M. T., D. S. C.)

Chemical analyses and other data on the heulandite and prehnite used in experiments described above are given below.

Heulandite

Locality: Cape Blomidon, Nova Scotia. Colourless crystals.

SiO_2 56·8; Al_2O_3 16·6; Fe_2O_3 tr.; MgO tr.; CaO 5·8; SrO 2·0; Na_2O 1·6; K_2O 0·8;