hat analcime is stable to
may thus form at much
e later). Experimental
lipsite in the mesostasis
p. 370) but thomsonite
) and can be interpreted
r low-temperature, late
nsonite in the Waihola
4) has discussed how the
in feldspathoidal rocks
nsonite in their zeolitic

zose rocks on the other
ite–stilbite group (e.g.
BRINDLEY (1954) have
on of a highly siliceous
o (1957) have recognized
on products of Japanese
for the silica-content

ents of widely differing
ve consider that it may
metamorphic facies, to
illonoid assemblages as
theless as stated above
cive of non-equilibrium
such as mordenite and

te in marine sediments
s, 1958), provide some
ation. These data are

STABILITY

m is one of increasing
ss to the less hydrated
tendency for phases to
. The general features
cks were subjected to

at low temperatures
t will consist largely of
nmonly developed, at

Table 1. Temperatures of occurrence of some natural zeolites and related minerals (data derived from references given in text)

Mineral	Occurrence	Temperature (T°C)	Depth (m)
Phillipsite	Deep sea sediments	0°	4000–5000
Chabazite, phillipsite, natrolite	Masonry, Roman baths	40–70°	Surface
Clinoptilolite, analcime	Diagenesis	Low	?
Stilbite	Hunters, Boulder Hot Springs	?64°, ?73°	Surface
Clinoptilolite	Yellowstone	125°	19–26
Analcime	Yellowstone	125–155°	26–60
Mordenite	Wairakei	150–230°	73–300
Heulandite	Wairakei	within range of mordenite	
Laumonite	Wairakei	195–220°	150–275
Wairakite	Wairakei	200–250°	180–600
Prehnite	Wairakei	~200°	~100
Albite	Wairakei	160–240°	100–600
Adularia	Wairakei	230–250°	385–650
Zeolite and adularia	Steam Boat Springs*	170°	52

Note: (1) The maximum temperatures recorded for the Wairakei boreholes are 250–260°C.
(2) The appearance of albite and other minerals at abnormally low temperatures and shallow depths in some Wairakei holes suggest that in these cases they may have been deposited under an earlier regime of higher temperatures.
* See WHITE (1955).

least partially, has been demonstrated in the previous survey. Further, the recurrence of simple assemblages suggests that equilibrium is often approached.

4.1. *The importance of silica activity*

In the low temperature regional environment where zeolite facies minerals are formed, equilibrium with silica normally implies equilibrium with quartz. But in some of the environments where zeolites are formed on a large scale, less stable modifications of silica, such as opal or cristobalite, may be present. This commonly occurs in active hydrothermal areas and also in shallow sediments where opaline silica may be a cement. A solution which is actively precipitating opaline silica must be supersaturated with respect to quartz, and experimental data indicate that the silica activity could be greater than in equilibrium with quartz by a factor of 10 (ELLIS and FYFE, 1957). Experiments described later suggest that a change of environment from one saturated with cristobalite to one saturated with quartz must change the maximum temperature of stability of a mineral assemblage. Natural zeolite assemblages reported above support this conclusion.

In any reaction of type:

$$A_xB_yC_z \rightleftharpoons A_xB_yC_{z-w} + C_w$$