not much older. The cave was self-sealed about 9,000 years ago, having been open only during the waning phase of the Pinedale Glaciation.

Original depositional layers of angular, pebble-sized roof debris should have been of nearly constant thickness on the nearly horizontal floor; disturbance of layers and periodic excavation of depressions indicate occupation by Man prior to 12,000 B.P. and at intervals during the following 3,000 years even though at times the cave was too low for erect posture. Corroborative evidence is supplied by the presence of artifacts and butchered bones. Included in the 44 species of mammals represented in the faunal remains are tundra-adapted Collared Lemmings, the world's oldest record of domesticated dogs, and six extinct species.

GEOPHYSICS APPLIED TO THE SEARCH FOR GEOTHERMAL ENERGY RESOURCES

Eaton, Gordon P., U.S. Geological Survey, Denver Federal Center, Denver, Colorado 80225

The history of geophysical exploration for geothermal energy resources has been too brief to provide consistent guidelines for the explorationist. Considerable uncertainty exists as to the actual physical nature of geothermal reservoirs. It is, nevertheless, possible to search for geothermal fluids in an approximate way, geophysically, even in the absence of well defined conceptual models. Many techniques currently are being, adopted, tested, or applied. Among these are: heat-flow measurements, thermal infrared imagery, direct-current and electromagnetic sounding and profile surveys, electrical self-potential surveys, geomagnetic variation soundings, airborne and ground magnetics, gravity, active seismic refraction and reflection surveys, microearthquake measurements, and seismic noise recording. Only those techniques related to present-day elevated temperature or steep thermal gradients are direct methods. Exploration on a crustal scale is now conducted by means of heat-flow measurements, geomagnetic variation and magnetotelluric soundings, and measurement of teleseismic P-wave delays.

Depending upon geologic circumstances, one may be looking for, (1) individual convecting hydrothermal cells or associated effects, such as intensive hydrothermal alteration; (2) bodies of magma (or their partially crystalline derivatives); or (3) permeable fracture systems along which hot fluids may be moving toward the surface from sources and depths unknown. Although hydrothermally altered rocks have somewhat predictable physical properties, their presence may or may not be significant, depending upon the age of the alteration. The search for magma is at present hampered by a serious lack of fundamental data on the physical properties of magma.

BROKEN OOIDS, CEREBROID OOIDS AND 'SPASTOLITHS': IMPLICATIONS FOR UNUSUAL SALINITIES IN THE MIDDLE CARBONATE INTERVAL, BELT SUPERGROUP (LATE PRECAMBRIAN), NORTHWESTERN MONTANA

Eby, David E., Department of Earth and Space Sciences, S.U.N.Y. at Stony Brook, Stony Brook, N.Y. 11794

Syndepositional breakage of calcareous ooids is often at least 100 times greater in modern hypersaline than normal marine settings (Halley, 1974). This interpretation is further supported by the presence of abnormally high breakage and other synsedimentary deformation in several ancient oolite sequences closely associated with evaporites that range in age from Mississippian through Triassic.

Ooids from numerous beds within and among measured sections of the Middle Carbonate Interval of the Belt Supergroup display breakage frequencies from nearly 0% to over 25%. Accompanying breakage in some

horizons are other types of penecontemporaneou
cracks resembling "spastoliths" (Carozzi, 196
(Carozzi, 1963). Both may indicate appreciab
expansion-recrystallization processes affecti
Furthermore, Belt oolites are frequently inte
containing calcite- and sediment-filled hoppe
primary disruption fabrics attributable to bo
dissolution of evaporite minerals. Throughou
tinctive nodular and laminar microspar-filled
as calcitized evaporites.

Horizons displaying ooid breakage and/or
mitted detailed stratigraphic correlation acr
for several tens of kilometers. These featur
episodes of widespread elevated salinities de
during middle Belt times, and represent valua
mation heretofore unrecognized within Belt ca

STRATIGRAPHY OF THE SOUTHERN BEAVERHEAD RANGE
COUNTIES, IDAHO

Embree, Glenn F., Hoggan, Roger D., Willia
College, Rexburg, Idaho 83440; Skipp, B
Survey, Denver, Colorado 80225

A 3,000-metre-thick incomplete sequence of ma
Paleozoic rocks has been mapped in detail in
Range where it is unconformably underlain by
capped by a remnant of Triassic rocks. The P
Formation, more than 600 m thick, is overlain
Ordovician Kinnikinic Quartzite. West of Cop
Devonian Jefferson Formation unconformably ov
Kinnikinic. Unnamed Upper Devonian and Lower
siltstones and limestones and the Upper Missi
the Middle Canyon Formation, which together a
formably overlie all older rocks, and underli
folded and faulted massive limestones of the
Formation. More deformed Mississippian lit
and Surrett Canyon Formations overlie the Sc
Copper Mountain and range from 150 to 200 m
most Mississippian Formation, the Big Snowy
interbedded shales and sandy and conglomerat
thick, is overlain conformably by Pennsylvan
upward into Pennsylvanian and Lower Permian
limestone, and dolomite totaling about 975 m
most 95 m of the Paleozoic sequence is inter
limestone and shale of the Permian Phosphori
overlain by a 36-m remnant of the Lower Tria
Flat-lying Tertiary volcanics and fanglomera
older rocks.

GEOLOGY AND MINERALIZATION OF THE TUBUTAM

Frye, Kenneth L., Department of Geolo
Iowa City, Iowa 52242

The Tubutama area is located 75km sout
and lies within the Sonoran Desert secti
physiographic province. The major topog
WNW trending fault block mountain. A Pr
comprising the mountain core is overlain
schists and phyllites of the Precambrian