

The constraints shown on this map are based on characteristics of the upper 3 m (10 ft) of deposits. Distribution of hazards is generalized and data is representative; this map should not serve as a substitute for site investigation.

**CALICHE PROBLEMS**

Caliche occurs in most pre-Holocene deposits in this quadrangle and is predominantly of pedogenic origin. Distribution, type, hardness, and thickness of caliche affect the severity of problem; the following units are listed in order of decreasing constraint with respect to these factors.

- A** Petrocalcic caliche occurs throughout as randomly distributed horizons, up to 1 m (3 ft) thick; massive, hard, concrete-like. Numerous horizons may be encountered at depth. Ripability low; requires specialized excavating equipment. Caliche horizons have little to no permeability and locally may produce perched water, which increases sulfate hazard. Contains numerous gypic horizons.
- B** Caliche unit described above occurs at shallow depth (<3 m; 10 ft).
- C** Surface and near-surface petrocalcic caliche; 0.5-3 m (1.5-10 ft) thick; massive, hard. Ripability low; generally requires specialized excavating equipment. Permeability low.
- D** Surface and near-surface petrocalcic caliche; >3 m (10 ft) thick; massive, hard, concrete-like; locally fractured. Ripability low; generally requires specialized excavating equipment. Permeability low in massive caliche; moderate to low in fractured caliche.
- E** Surface and near-surface petrocalcic caliche; generally 1 m (3 ft) thick; underlain by uncemented gravels; massive, hard, concrete-like; locally fractured. Ripability low in massive material; generally requires specialized excavating equipment.

**F**

Surface and near-surface petrocalcic and calcic caliche; generally 1 m (3 ft) thick; underlain by uncemented gravels. Type and distribution can vary greatly over short distances. Petrocalcic caliche is massive, hard, locally fractured; generally requires specialized excavating equipment; permeability low. Calcic caliche is massive, hard, locally fractured; generally requires only conventional excavating equipment; permeability moderate to low. Permeability good to excellent in underlying gravels.

**G**

Near-surface calcic caliche with isolated petrocalcic horizons; 1-1.5 m (3-5 ft) thick; underlain by gypic or petrocalcic horizons. Calcic caliche is massive, hard, locally fractured; permeability moderate to good. Petrocalcic caliche is massive, hard, commonly fractured. Ripability of unit moderate to good; generally requires only conventional excavating equipment.

**H**

Near-surface calcic caliche; generally <1 m (3 ft) thick. Varies from moderately hard, blocky caliche to soft, friable, nodular type. Ripability good; requires only conventional excavating equipment. Permeability good to excellent.

**I**

**SOLUBLE SULFATE HAZARDS**  
Most alluvial materials within this quadrangle contain soluble sulfate contents in excess of 0.2% by weight, requiring special construction techniques and sulfate-resistant concretes. The following units present the most severe sulfate hazards.  
**J** Surface and near-surface gypic and petrocalcic horizons; soft to moderately hard. Horizons are generally <1 m (3 ft) thick and occur at random vertical stratigraphic intervals. Unit capable of supplying extremely high dissolved  $\text{SO}_4$  upon saturation.

Gypic and petrocalcic horizons below a 1-2 m (3-7 ft) veneer of alluvium. Gypsum is soft to moderately hard; 1-3 m (3-10 ft) thick. Unit capable of supplying extremely high dissolved  $\text{SO}_4$  upon saturation.

**K**

Surface and near-surface disseminated saline deposits derived from leaching of upland areas. Surface characteristically covered by 0.5-1 cm (0.25-0.5 in) thick white saline crust. Sulfate readily available in solution because of high water table. Unit is highly susceptible to growth of heaving salt (hydrated sodium sulfate) based on soil type, salt concentrations, and high water levels. Contains hazardous high chloride concentrations. Free of petrocalcic, calcic, petrocalcic, and gypic horizons.

**GENERAL**

Generally free of petrocalcic, thick calcic, petrocalcic, and thick gypic horizons, and high saline concentrations. Unit may locally overlie other near-surface hazardous deposits. Bedrock; locally subject to rockfalls.

**FAULT HAZARDS**

Fault delineation is based primarily on air-photo interpretation and is not intended to substitute for additional subsurface investigation.

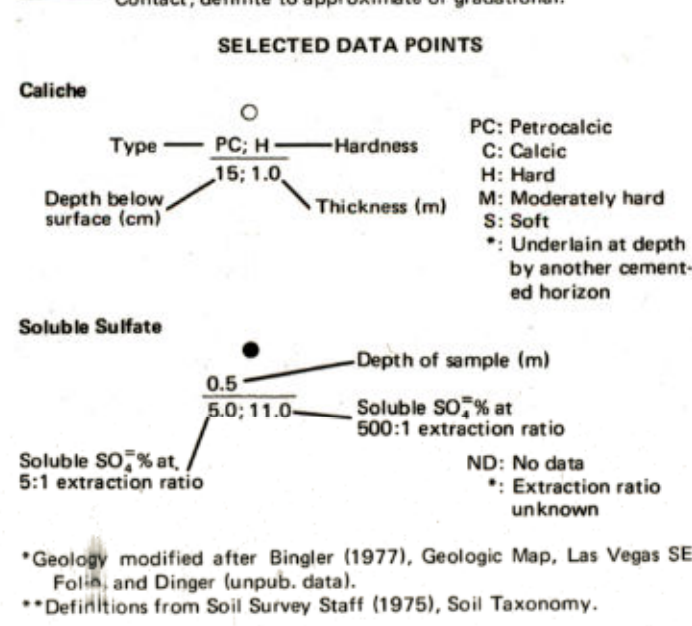
**Fault or fault-line scarp:** compaction and/or tectonic origin; locally resequent or restructured scarp. Black: last movement probably of pre-Pleistocene age (>1.8 m.y.). Blue: last movement probably of mid-Pleistocene age (>0.5 m.y.), possibly of late Pleistocene age (>10,000 yrs). Dashed where approximately located; dotted where concealed; ball on downthrown side.  
**Probable fault or fault-line scarp:** linear or curvilinear escarpment. Blue: last movement probably of mid-Pleistocene age (>0.5 m.y.). Red: last movement probably of late Pleistocene age (>10,000 yrs). Dotted where concealed.

Fault or fault-line scarp in depositional contact with younger alluvium.

**FISSURING HAZARD**

Fissures; possible compaction and/or tectonic origin. As much as 2 m (6 ft) deep, 1 m (3 ft) wide.

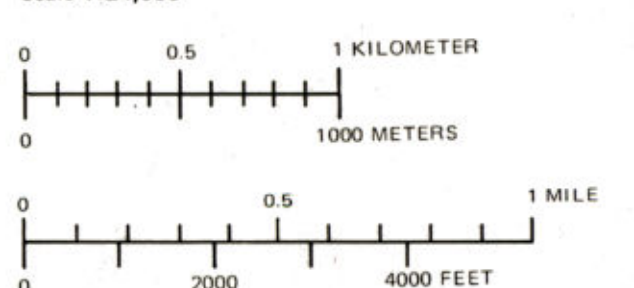
Contact; definite to approximate or gradational.

**SELECTED DATA POINTS**

John W. Bell, 1978

Fissuring data by Ralph O. Patt, Desert Research Institute

Scale 1:24,000



CONTOUR INTERVAL 20 FEET

DOTTED LINES ARE 10-FOOT CONTOURS

DATUM IS MEAN SEA LEVEL

Topographic base from U. S. Geological Survey Las Vegas SE 7 1/2' quadrangle, 1967

Cartography by Susan L. Nichols

NEVADA BUREAU OF MINES AND GEOLOGY  
UNIVERSITY OF NEVADA  
RENO, NEVADA 89597  
ORDER MAP NO. 3Am