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POTASH DEPOSITS IN THE GIBSON DOME AREA, SOUTHEAST UTAH

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INTRODUCTION

In the Gibson Dome area of the Paradox Basin in southeast Utah, potash deposits are present in the Middle Pennsylvanian Paradox Member of the Hermosa Formation. Gibson Dome is located about 16 miles south of Moab, in San Juan County, Utah (fig. 1). The area includes three small salt anticlines; Gibson Dome, Rustler Dome, and Lockhart Anticline.

The Department of Energy recently completed a deep corehole (GD-1) on the southeast end of the Gibson Dome structure (fig. 2). The entire evaporite sequence of the Paradox Member was cored in this hole, allowing the potash deposits to be sampled and evaluated. The principal purpose of this report is to relate the presence of potash deposits at Gibson Dome to two areas: Davis Canyon and Lavender Canyon, which are currently being considered by the Department of Energy as potential sites for a high-level nuclear waste depository (fig. 2).

POTASH DEPOSITS

The potash deposits of the Paradox Member are associated with a series of evaporite cycles. At least 29 cycles have been recognized, and 18 are known to contain potash. The principal potash deposits in the Gibson Dome area are in evaporite cycles 6, 13, and 18. Trace amounts of potash also occur in evaporite cycles 7, 9, 19, and 21. Because of regional thinning and the loss of several salt beds at the top of the evaporite sequence, two of the deeper potash deposits (cycles 13 and 18) are present at depths potentially favorable for conventional shaft mining in this location.

Cycle 6 - Potash

In the Gibson Dome area, potash in cycle 6 is present in a unit commonly referred to as the "Carnallite Marker" (Hite, 1960). The Carnallite Marker has great regional extent and locally attains thicknesses of over 100 feet. Throughout the Paradox Basin, this deposit, on the basis of interpretations from geophysical logs, appears to consist principally of carnallite. The potash content of this deposit throughout its regional extent is consistently low, and for that reason, it is considered to have no economic potential. In GD-1 core hole, the deposit is about 130 feet thick, and except for trace

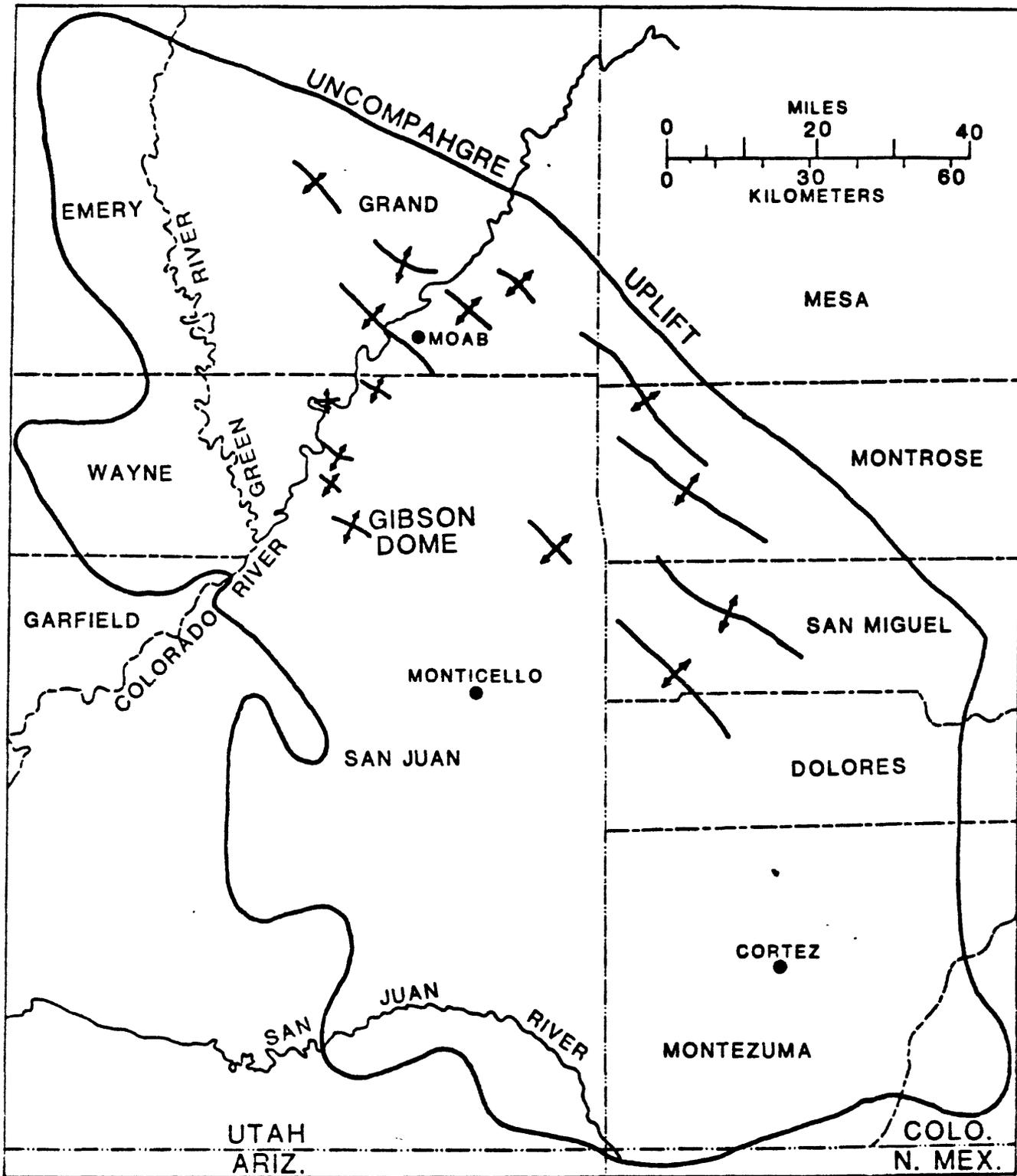


Figure 1.--Index map of Paradox Basin showing salt anticlines and limits of halite and potash in the Paradox Member of the Hermosa Formation.

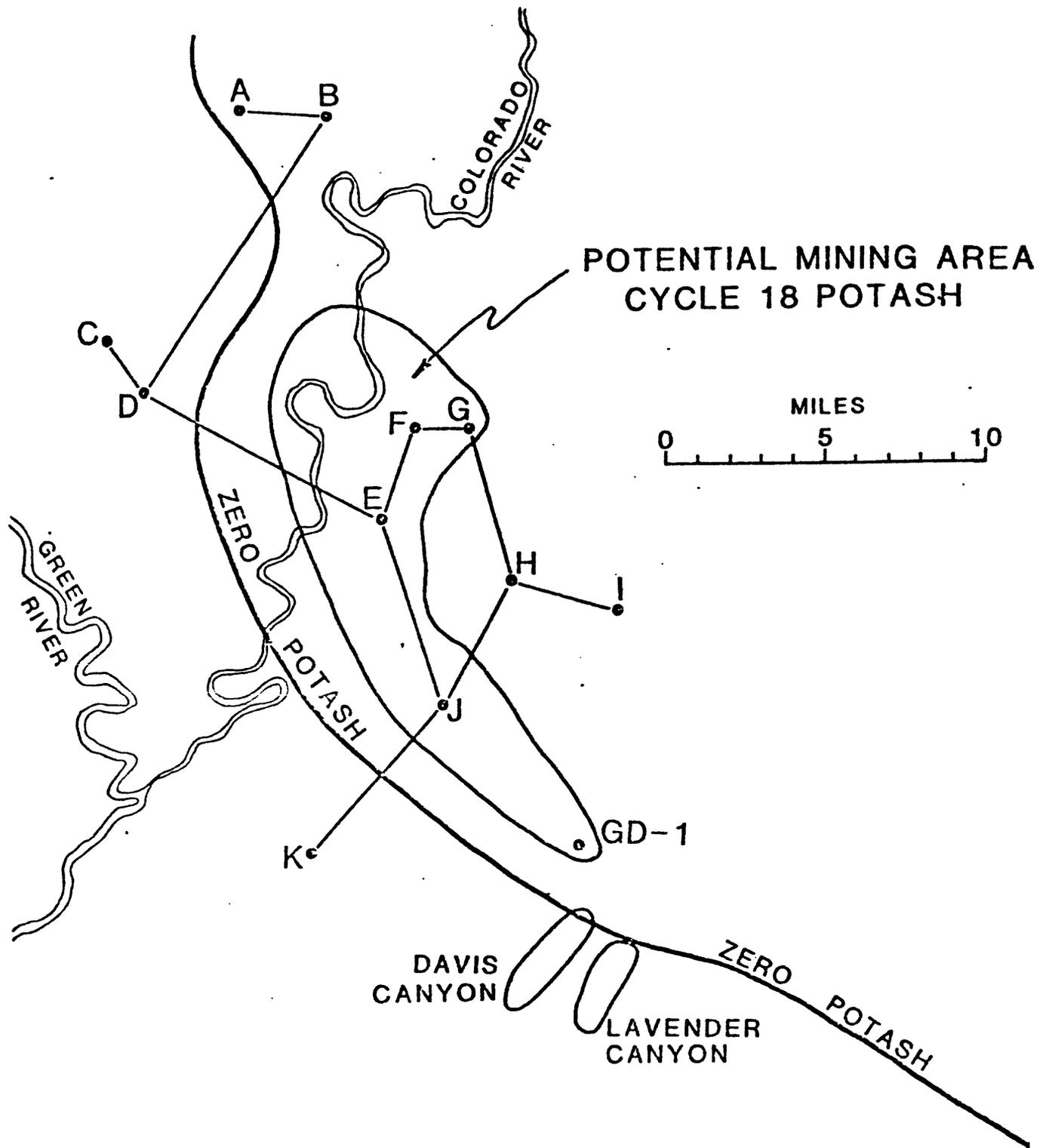


Figure 2.--Index map of the Gibson Dome area showing lines of section for figure 5 and potential mining area for cycle 18 potash.

amounts of sylvite near its top, the only other potash mineral present is carnallite. The carnallite occurs in halite rock, which is prominently banded by thin laminae of anhydrite. The carnallite is distributed as thin stringers and scattered crystals which are aligned with the anhydrite laminae. Minor amounts of the mineral kieserite ($\text{MgSO}_4 \cdot \text{H}_2\text{O}$) are associated with the carnallite. The entire carnallite deposit averages about 1 percent K_2O (fig. 3). Two thin intervals (3,250 to 3,254 feet and 3,262 to 3,264 feet) near the base of the deposit average 4.1 and 2.4 percent K_2O respectively. In summary, the carnallite deposit in evaporite cycle 6 has a thickness that would be attractive for solution mining development; however, the K_2O content of the deposit is so low that any future exploitation is very unlikely.

Cycle 13 - Potash

Evaporite cycle 13 contains potash over a large part of the Paradox Basin and is particularly well developed about 30 miles north of the confluence of the Green and Colorado Rivers where it has been noted as being potentially favorable as a solution mining target (Hite, 1976). This deposit is also present in the Gibson Dome area where it is much thinner and lower in grade (fig. 4). In the GD-1 corehole, this deposit consists of a 6.2-foot-thick interval of sylvite with an average grade of 16.5 percent K_2O . By itself, the deposit would not attract development considering near term potash economics. However, if shaft mine facilities existed in this area, as the result of exploitation of underlying cycle 18 potash, then this deposit might eventually be mined.

Cycle 18 - Potash

The potash deposit in evaporite cycle 18 can be correlated over a large part of the Paradox Basin. This deposit is particularly well developed along the Colorado-Utah State line near the town of Dove Creek. In the Dove Creek area, the grade and thickness is sufficient to suggest favorable potential for solution mining (Hite, 1978). The potash in cycle 18 consists of two sylvite deposits separated by a barren interval of halite, which averages about 40 feet in thickness. Both the upper and lower sylvite deposits contain thin layers of anhydrite rock. Over much of the Gibson Dome area both sylvite deposits are present (fig. 5). These deposits are of sufficient thickness and grade to constitute minable deposits according to current potash economics.

GIBSON DOME # 1

POTASSIUM DISTRIBUTION

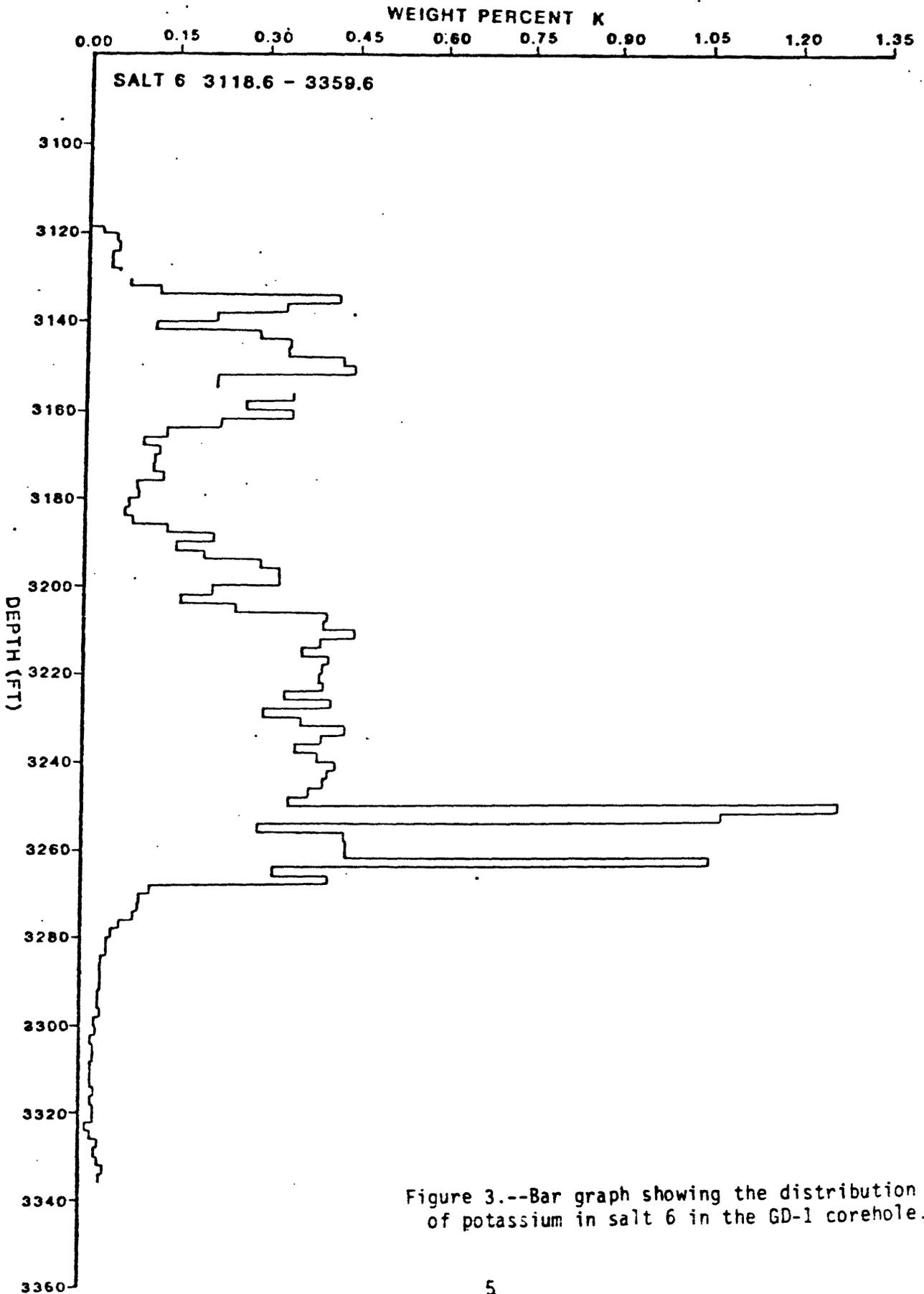


Figure 3.--Bar graph showing the distribution of potassium in salt 6 in the GD-1 corehole.

SALT # 13 POTASH DEPOSIT

GIBSON DOME # 1

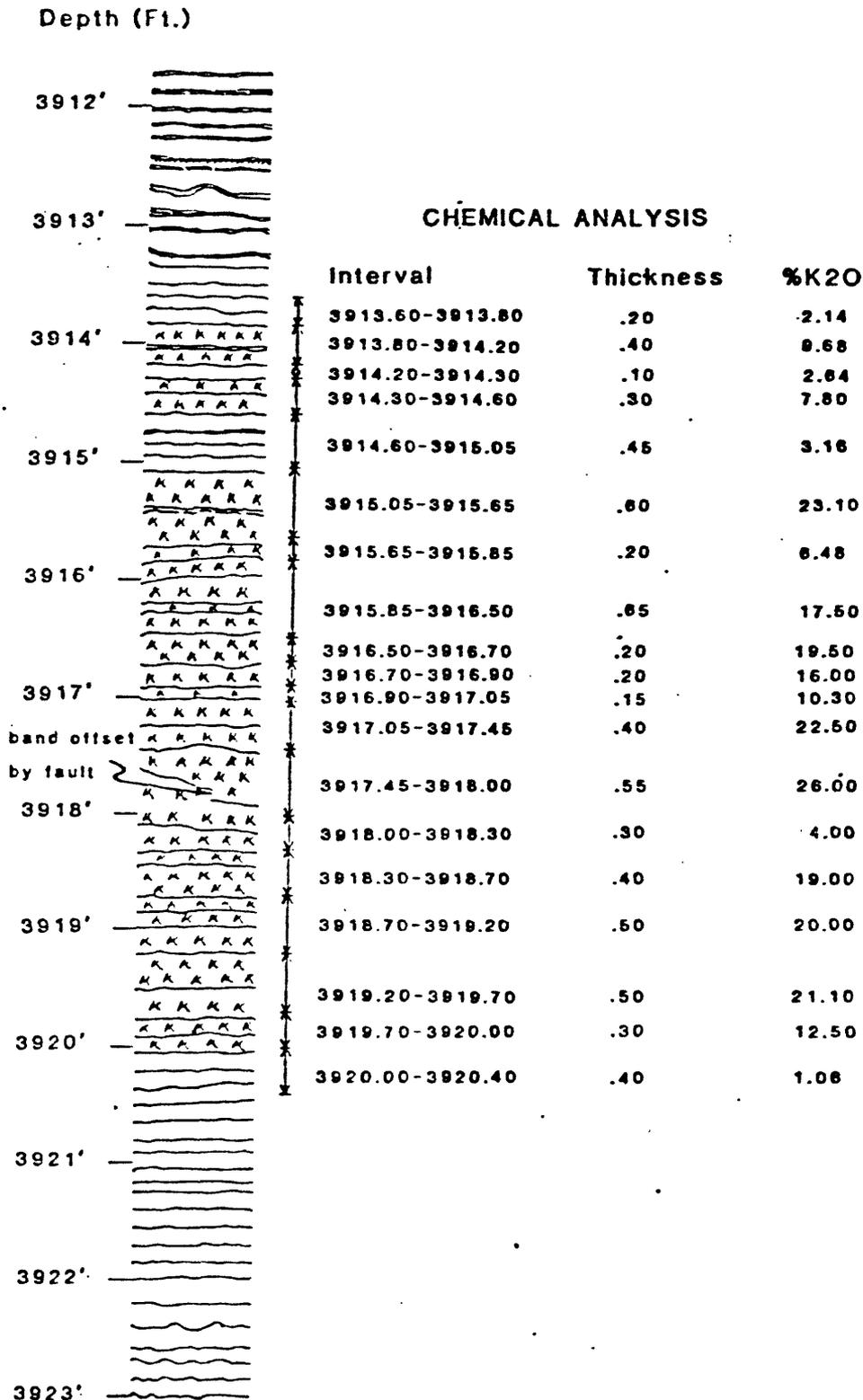


Figure 4.--The distribution of sylvite (represented by the letter K in the left column) and anhydrite laminae (horizontal lines) in the cycle 13 potash deposit. Chemical analyses (percent K₂O) of composited sample intervals are shown on the right.

In the crestral portions of Gibson Dome, Rustler Anticline, and Lockhart Anticline, the deposits range in depth from 3,400 to 4,100 feet, which is somewhat deep for exploitation by conventional shaft mining. However, considering that potash is being mined in Canada at 3,300 feet and in England at 4,000 feet, the depths in the Gibson Dome area are not necessarily prohibitive.

In the GD-1 corehole, only the upper deposit was present. This deposit which is present between the depths of 4,428.6 and 4,436.8 feet, consists of 8.2 feet of sylvite averaging 22.1 percent K_2O (fig. 6). It is doubtful that a mining company would sink a shaft to mine ore at 4,400 feet. However, it is possible that if access were made to the deposit at shallower depths, mining could proceed downdip to such depths.

Summary

Potash deposits in evaporite cycle 18 in the Gibson Dome area constitute one of the few remaining attractive potash resources in the United States within the reach of conventional shaft mining. As a result, these deposits may attract some exploration effort within the next decade. It is also quite probable that within the next century these deposits will be mined. The western limit of these deposits is poorly defined, but it is likely that they do not underlie Davis and Lavender Canyons.

References

Hite, R. J., 1960, Stratigraphy of the saline facies of the Paradox Member of the Hermosa Formation of southeastern Utah and southwestern Colorado: Four Corners Geological Society, Field Conference 3, Guidebook, p. 86-89.

_____ 1976, A potential target for potash solution mining in cycle 13, Paradox Member, near Moab, Utah: U.S. Geological Survey Open-File Report 76-755.

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SALT #18 POTASH DEPOSIT
GIBSON DOME NO.1

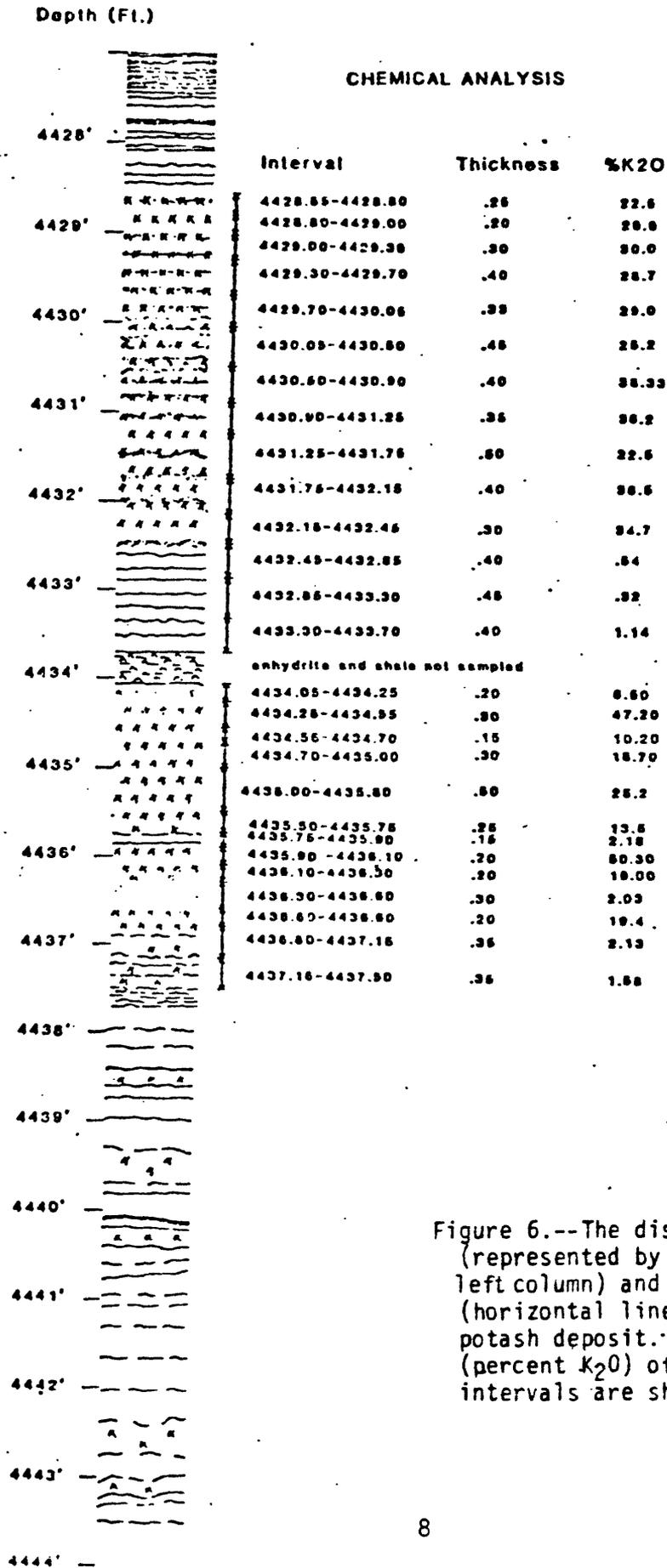


Figure 6.--The distribution of sylvite (represented by the letter K in the left column) and anhydrite laminae (horizontal lines) in the cycle 18 potash deposit. Chemical analyses (percent K₂O) of composited sample intervals are shown on the right.