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Winkler Anticline Fluorspar, Hidalgo County, New Mexico

New Mexico State Bureau of Mines and Mineral Resources

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Target Exploration Report E-3

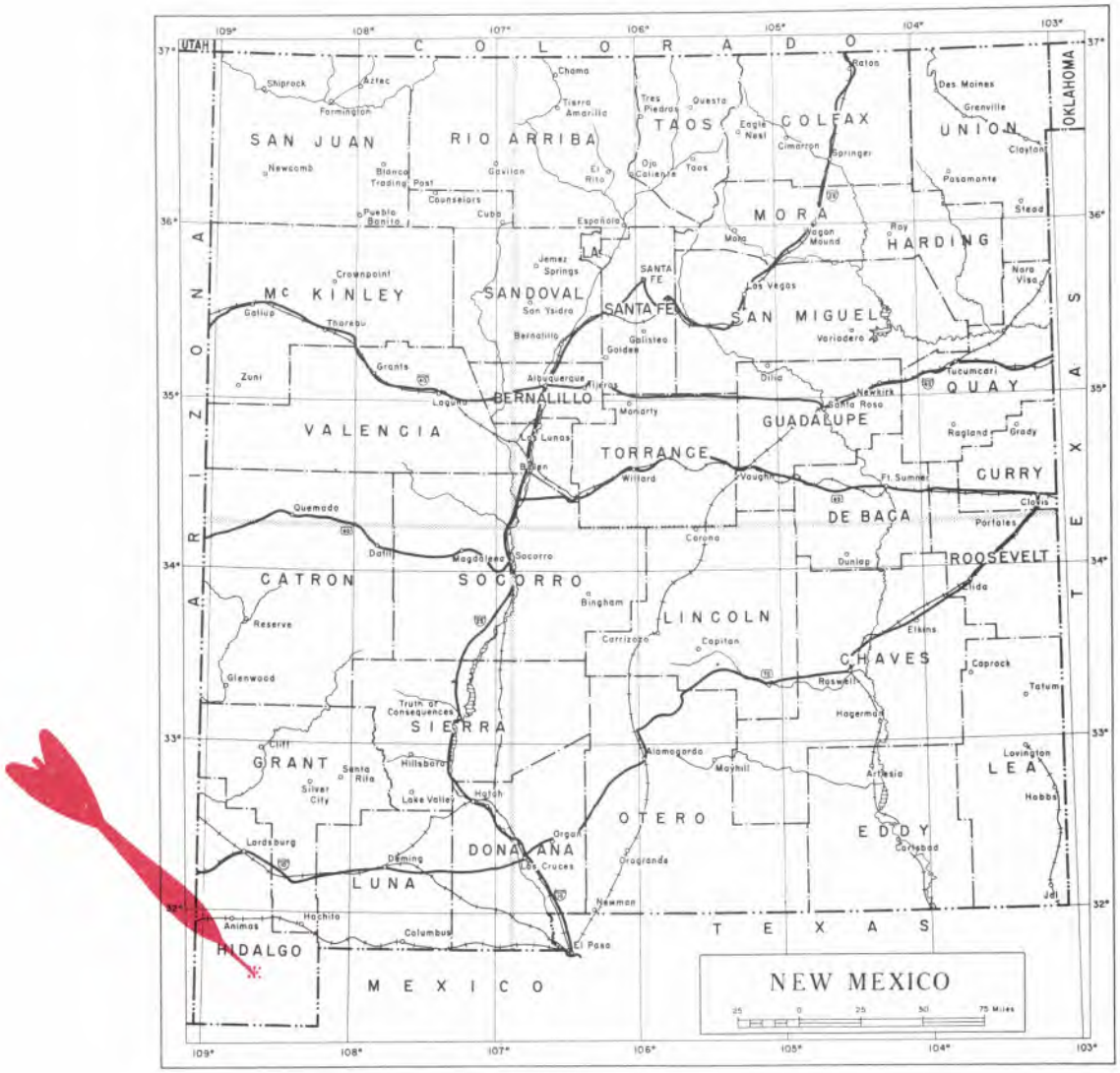
WINKLER ANTICLINE FLUORSPAR
HIDALGO COUNTY, NEW MEXICO

by W. N. McAnulty, Sr.

The University of Texas at El Paso

The main purpose of this series is the immediate release of significant new exploratory information which otherwise would have to await release at a much later date as part of a comprehensive and formal document. These data are preliminary in scope, therefore, subject to revision and correction.

Socorro, May 1972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SUMMARY

Recent work in the area of the Winkler anticline in the Animas Mountains, Hidalgo County, New Mexico has resulted in discovery of potentially commercial deposits of fluorspar. Extensive low-grade (30± % CaF_2) deposits occur in concordant silicified limestone breccia zones (up to 30 feet thick, average about 20 feet) in both the Horquilla (Permian) and U-Bar (Cretaceous) formations. The larger deposits appear to be in the Horquilla Limestone. Small, irregularly shaped pockets of high-grade fluorspar are present in the upper part of the U-Bar Formation. Fluorspar deposits also occur intermittently along the U-Bar fault. Further prospecting and exploration are recommended for the Winkler anticline as well as the Little Hatchet and Big Hatchet mountains.

INTRODUCTION

Fluorspar occurs over several hundred acres on the Winkler anticline in the Animas Mountains, approximately 25 miles north of the international boundary, in southeastern Hidalgo County, New Mexico. Recent geologic mapping, prospecting, and exploratory work including drilling, test-pitting, trenching, and analyses of drill cuttings and bulk samples, indicate sizeable reserves of low-grade and lesser amounts of high-grade fluorspar. More geologic study, exploration, and metallurgical testing are needed to adequately evaluate the economic potential of the district.

During the summer of 1970 Roger D. Ellis conducted a geologic study in the area of the Winkler anticline. His thesis entitled "Geology and Ore Deposits of the Winkler Anticline, Hidalgo County, New Mexico," includes a detailed geologic map and descriptions of the fluorspar occurrences.

During 1970 and 1971, the Texas Lime Company of Cleburne, Texas, a division of Rangaire Corporation, partially explored and sampled fluorspar deposits on 10 claims in the Athena group located in the northeast corner of section 3, R. 18 W., T. 31 S., using air-track percussion drilling (50 100-ft. holes), bulldozer trenching, and test-pitting. In 1971 Jim Wilson, and others, partially explored deposits on claims located immediately south of the Athena group, in the same section, by means of bulldozer trenching and scalping. Both the Ellis study and the Texas Lime Company project were directed and supervised by the writer.

A flurry of prospecting activity took place in the area of the Winkler anticline in the early 1880's -- silver being the commodity of interest; the Gillespie Mining District was organized during that period. The Gillespie prospect, located on the northwest flank of the central portion of the anticline, was explored with a 150-foot shaft and a few adits. There is no record of any production.

During the 1940's some prospecting for silver was done in the district again. In the 1960's, a few shallow trenches and test pits were excavated on fluoritized outcrops in the eastern part of the area. Texas Lime Company conducted a fluorspar exploration project on the Athena claims during 1970-71. Currently, the Mine and Mill Company is setting up a heavy media mill and preparing to produce fluorspar from deposits on the Athena claims.

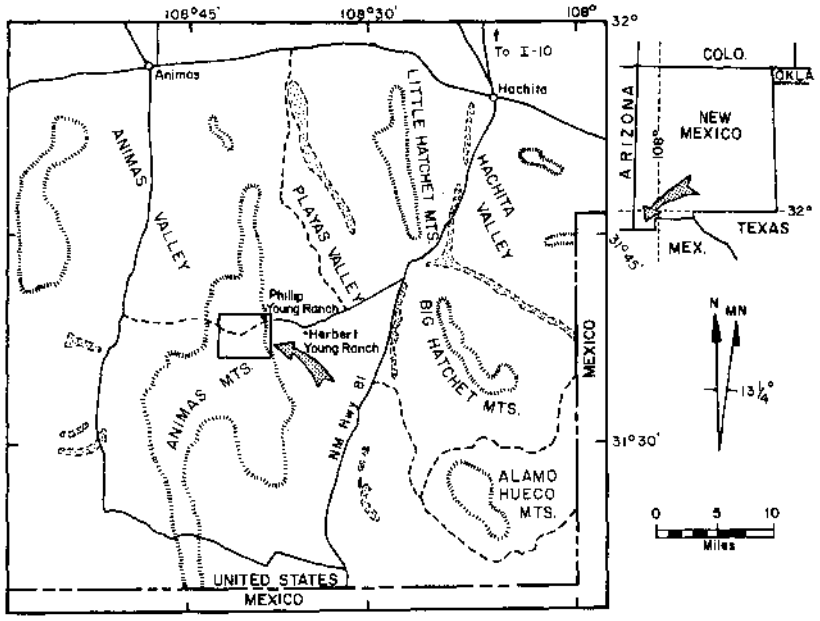

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Figure 1 – Location and setting of study area.

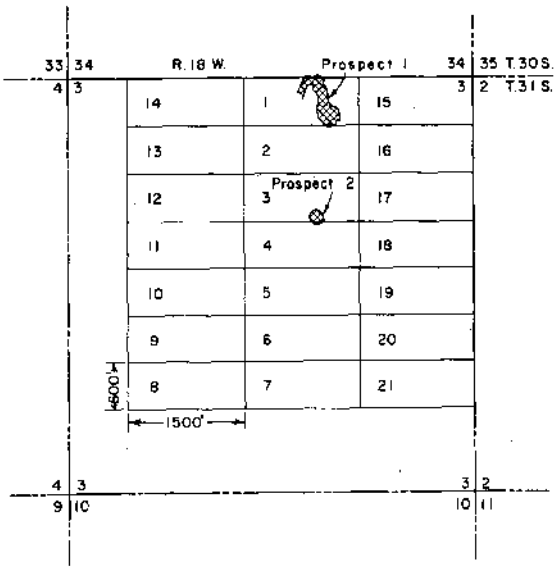

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Figure 2 – Principal prospects in Athena mining claims.

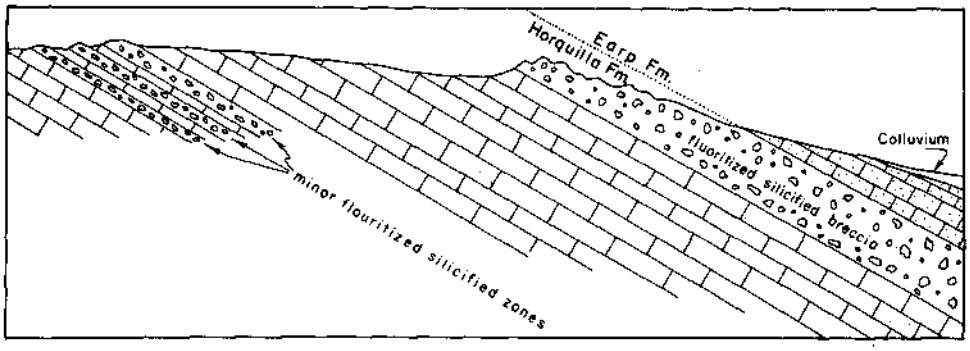

Figure 3 – Diagrammatic cross section at prospect 1.

STRATIGRAPHY AND STRUCTURE

The Winkler anticline is a northeast-trending, doubly plunging, elongated anticlinal structure, about 3 miles long and 1½ miles wide. It plunges out to the northeast and is intruded by the quartz monzonite Walnut Wells stock on the southwest.

Rocks of Permian, Cretaceous, and Tertiary ages are involved in the folding, and crop out in the area. Three Wolfcampian (Permian) formations crop out over the axis and surrounding upper flanks of the anticline. From oldest to youngest the formations are: *Horquilla Limestone,* a thick-bedded to massive, medium-crystalline, gray limestone; *Earp Formation,* a sequence of thin-bedded shales and siltstones; and *Colima Limestone,* a thin- to medium-bedded, finely crystalline, black limestone.

Approximately 4,100 feet of Fredericksburg strata (Lower Cretaceous) are exposed on and around the Winkler anticline. This sequence has been divided into three formations from bottom to top: *Hell-to-Finish Formation*, 769 feet of shale, mudstone, siltstone, and limestone-pebble conglomerate; *U-Bar Formation*, 1,742 feet of thick-bedded and reefy limestones, reddish-brown sandstones, and medium-bedded oyster-coquina limestones; *Mojado Sandstone*, 1,600 feet of medium- to thick-bedded, reddish-brown sandstone with thin interbeds of gray to black shales.

Rocks of Tertiary age which crop out on the flanks and immediate surrounding area of the Winkler anticline include about 3,800 feet of fanglomerate, volcanic breccia, rhyolitic and latitic tuffs, and andesite lava flows. Intrusive rocks include the Walnut Wells stock, a large body of quartz monzonite porphyry, and several dikes and sills of quartz latite.

Deformation may have begun in the area of the Winkler anticline in Permian time (Zeller and Alper, 1965). Development of the structure during the post-Permian to pre-Cretaceous interval is evident, but the greatest development appears to have been during early to mid-Tertiary time -- probably the result of intrusive igneous activity.

Several faults are in the area; stratigraphic displacements range from a few feet to more than 2,000 feet. One of the most conspicuous, the U-Bar fault, cuts the southeast limb of the anticline, striking nearly parallel with the anticlinal axis, and is mappable along its strike for about two miles. Nearly vertical fault scarps, up to 20 feet high, are present along this fault at intervals where it crosses the limestones of the U-Bar Formation. According to Ellis (1971), stratigraphic displacement along the U-Bar fault is approximately 500 feet. Fluorite, calcite, and considerable quartz occur intermittently along this fault. Several smaller normal faults, with strikes parallel or sub-parallel to the U-Bar fault and the axis of the anticline, are present in the area between the U-Bar fault and the axial trend, especially on the northeast end of the anticline.

Several northeast- and northwest-trending faults intersect in the area of the old Gillespie prospect, on the northwest flank of the anticline west of the Athena claim group.

MINERALIZATION

Fluorite (CaF_2) probably is the only economic mineral concentrated in commercial-size deposits in the area of the Winkler anticline. Fluorspar is any aggregate of rock and mineral matter containing enough fluorite to make the ore deposit commercially minable. Minor amounts of oxidized copper minerals (azurite and malachite) and traces of sulfides occur in and around the old Gillespie prospect. Reportedly, cerargyrite (AgCl) is present in the area, but none was seen. Calcite and quartz are abundant.

Fluoritization is widespread in the Horquilla Limestone, with coarsely and finely crystalline fluorite filling open spaces in breccias along bedding-plane faults. Fluorite also occurs at several places in the U-Bar Formation in the form of pods and irregular veins along faults, particularly the U-Bar fault, and in collapse (?) and bedding-plane fault breccias. The largest potential commercial deposits appear to be in the Horquilla Limestone, but further prospecting and exploration in the U-Bar Formation could reveal larger deposits. All of the known fluorspar occurrences are in section 34, T. 30 S., R. 18 W., and sections 3, 4, and 9, T. 31 S., R. 18 W.; the principal occurrences are in section 34, T. 30 S., R. 18 W.

Prospects

Two sizeable fluoritized areas of Horquilla Limestone crop out on the Athena mining claims located in the northeast corner of section 34. Both these outcrops were explored by Texas Lime Company. The areas were designated prospect 1 and prospect 2 (fig. 2). Within the area covered by the Athena claims, outcrops of the Horquilla Limestone contain several concordant silicified limestone zones – all brecciated to some extent, and strongly brecciated in places. Coarse and fine, euhedral to subhedral fluorite and quartz fills in the breccia, and some fine-grained fluorite has partially replaced original limestone breccia clasts. Radiating crystals of quartz growing on euhedral crystals of fluorite are common. The fluorite is vari-colored, clear, green, white, purple, and yellowish brown.

Prospect 1

The larger of the two fluoritized outcrops on the Athena claims is designated prospect 1. In this area Horquilla strata strike N. 40° W. and dip 30° to northeast. The fluoritized zone crops out across the upper slope of the plunging northeast end of a ridge along the axis of the anticline. This fluoritized zone is in strongly silicified and brecciated rock near the top of the Horquilla Limestone, and is covered on the lower slope by silty and clayey limestone of the Earp Formation (fig. 3). The Earp Formation increases in thickness downdip (northeast). A drill hole located on the lower slope penetrated 55 feet of the Earp before passing into the fluoritized zone beneath. The fluoritized outcrop in prospect 1 covers an area of approximately 100,000 square feet. Drilling revealed a zone thickness of 15 to 35 feet, the average being about 20 feet.

Prospect 2

Prospect 2 is located about 300 yards southwest of prospect 1. It, too, is on the northeast slope of a ridge of Horquilla Limestone. The fluoritized zone crops out on the upper slope but is covered by the Earp Formation in the middle and lower portions of the slope. This area is more complex structurally than prospect 1; prospect 2 is cut by one or more faults, and the strata are more steeply inclined. The area of the outcrop is smaller, and the thickness of the zone more variable, ranging from 0 to 38 feet.

Wilson Prospect

The Wilson prospect is located in the southeastern part of section 34, immediately south of the Athena claim group. Fluoritization is in the U-Bar Formation; but mineralization is quite similar to that in the Horquilla Limestone in prospects 1 and 2.

The fluoritized zone crops out over an area of about 70,000 square feet on a dipslope of U-Bar Limestone, on the upthrown side of, and marginal to, the U-Bar fault. Bulldozer trenches and scalping in this area reveal scattered, irregular-shaped "beds" of high-grade, coarsely crystalline fluorite, and void-filling fluorite in silicified breccia similar to the fluoritized breccia zones in the Horquilla Limestone. This area has not been drilled, therefore thickness of the fluoritized zones is unknown.

Other Outcrops

Fluorspar crops out intermittently in the fault zone along the U-Bar fault over a distance of several hundred feet westward from the Wilson prospect. Also, several small outcrops in the Horquilla Limestone are scattered over the area immediately west and southwest of prospect 1 on the Athena claims.

Source of Mineralizing Fluids

Fluorine is a distinctive constituent of alkali-rich magmas; and fluorite is commonly associated with alkalic, silicic igneous rocks. Nearly all commercial deposits of fluorspar appear to have formed directly or indirectly from hydrothermal fluids expelled from the magma chambers which gave rise to the intrusive igneous rocks with which the deposits are associated.

As the Walnut Wells stock of quartz monzonite porphyry cuts the southwest end of the Winkler anticline, and probably extends beneath the main portion of the anticline and adjacent Gillespie Mountain, widespread fluoritization occurs – probably the result of fluorine-bearing fluids, having been given off as late hydrothermal emanations from the Walnut Wells magma chamber. The igneous activity played a dual role: 1) by intruding the host rock and preparing sites favorable for fluorite deposition and concentration, and 2) by supplying the fluorine which reacted with the host rocks and formed fluorite deposits.

The brittle Horquilla Limestone, in which most of the known fluorspar in the area occurs, was brecciated along bedding planes as the result of bedding-plane slippage (faulting) caused by uplift and bowing of the beds in mid-Tertiary time. This deformation probably was produced by emplacement of the Walnut Wells stock at a relatively shallow depth below the present surface. As the underlying magmas cooled and solidified, silica-rich hydrothermal solutions moved out from magma and the deeper magma chamber into the country rock along the brecciated zones and replaced the brecciated limestone, producing a fine-grained quartzose rock. Upward movement of the hydrothermal fluids was blocked or slowed by the overlying relatively impervious Earp Formation. However, some of the hydrothermal solutions moved upward along faults and fractures and spread out along brecciated bedding planes in the U-Bar Formation.

There were at least two stages or pulses of hydrothermal mineralization. The first-stage solutions were rich in silica and almost completely replaced brecciated limestones in both the Horquilla and U-Bar formations. A small amount of fine-grained fluorite was formed along with the silicification during the first stage. Following silicification another period of movement along bedding planes resulted in strong brecciation of previous silicified limestone breccia zones. This movement, which may have been caused by shifting of the intrusive magmatic body at depth, was followed by a second stage of hydrothermal activity with solutions containing less silica and more fluorine, and coarse crystalline fluorite was precipitated in the open space between brecciated fragments of silicified limestone. Coarse-grained fluorite was also deposited during this stage in open spaces along faults and fractures, as for example along the U-Bar fault.

Grade

The nature of the silicified breccia zones is such that determining a reliable average grade is very difficult. It cannot be done by analyzing chip or channel samples cut from a few surface outcrops, or by analyzing drill cuttings obtained by air-track drilling. However, the average of analyses of bulk samples out of an aggregate total of about 5 tons taken from three 4-feet x 5-feet shafts, each approximately 20 feet deep, located at widely spaced intervals on prospect 1, probably represents the average of the whole fluoritized zone in that area. The CaF_2 content varies greatly over short

distances, both horizontally and vertically, ranging from more than 60 percent to less than 5 percent. SiO_2 is the principal gangue.

Bulldozer cuts on the Wilson prospect expose 3 to 5 feet of high-grade, coarsely crystalline and sugary fluorspar containing more than 90 percent CaF_2. The high-grade fluorspar of this type, however is probably limited to a few scattered, irregularly shaped pockets near the surface; and the total aggregate tonnage of the high-grade ore will probably be less than 2,000 tons. Most of the fluorspar in the area of the Wilson prospect probably occurs in a silicified breccia zone in limestone in the U-Bar Formation, much like the fluoritized silicified breccia zone occurrences in the Horquilla Limestone in the area of prospects 1 and 2. The CaF_2 content of the breccia zone rock is estimated to average 30± percent.

Analysis bulk samples from test pits at prospect 1
(El Paso Chemical Laboratories)

Sample	CaF_2	$CaCO_3$	SiO_2
1	38.04%	5.23%	49.95%
2	27.65%	1.39%	65.85%
3	34.58%	1.52%	60.72%
Average	33.42%	2.71%	58.84%

Amenability of Ore to Beneficiation

The amenability to beneficiation of the high-grade, coarsely crystalline fluorspar, as occurs on the Wilson prospect, is unquestioned. It can be up-graded to either ceramic or acid grade by simple washing methods; it could be sold as metallurgical grade without any treatment. Up-grading of the fluoritized silicified breccia rock to a saleable product, however, may be very difficult, if not economically impossible. Most of the fluorite in the breccias appears to be coarse grained and probably could be separated easily from the dominately quartz gangue by heavy media (sink-float) flotation. But an unknown amount of the CaF_2 content in the breccia is in fine-grained fluorite which probably cannot be separated by the sink-float process. Therefore, both heavy media and froth flotation may be required to produce a saleable product.

Reserves

Approximately 150,000 tons of rock containing 25 to 35 percent CaF_2 were found by drilling outcrop areas of prospects 1 and 2 on the Athena claims. Chances are good for finding a much larger tonnage of similar rock by drilling downdip from these outcrops. Other occurrences in the district have not been drilled. Apparently the amount of high-grade ore in the district may be limited to a few thousand tons.

RECOMMENDED PROSPECTING AND EXPLORATION

Winkler Anticline

None of the several known occurrences of fluorspar in the area of the Winkler anticline has been explored adequately. Careful prospecting in the district would probably result in discovery of several new occurrences. The outcropping portion of the uppermost fluoritized zone in the Horquilla Limestone has been explored (prospects 1 and 2), but the downdip, covered extension of this zone has not been explored; doubtless, it continues for some distance downdip underneath the Earp Formation. Also, two or more fluoritized breccia zones occur at lower horizons in the Horquilla Limestone, as shown by outcrops immediately southwest of prospect 1; but these zones have not been investigated at depth. The Wilson prospect in the U-Bar Formation and several occurrences along the U-Bar fault should be drilled, and explored further by excavations.

Because the contacts between the Walnut Wells stock of quartz monzonite porphyry and intruded carbonate strata around the southwest end of the anticline are covered by either alluvium or younger volcanic rocks, the buried contacts with the Horquilla Limestone and U-Bar Formation should be sought and sampled by drilling. Large replacement deposits of high-grade fluorspar are found in similar environments at many places in Mexico and elsewhere. The possibility of the Walnut Wells stock or a similar intrusive body of silicic igneous rock underlying most or all of the anticline is strong; and this possibility should be investigated by drilling at several places on the structure.

Little Hatchet and Big Hatchet Mountains

Occurrences of fluorspar are known in the Little Hatchet Mountains; and the geologic environment is favorable for deposits in the Big Hatchet Mountains, especially in areas near silicic intrusive rocks. Prospecting in these areas should be rewarding.

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