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NMBGMR Open-file Map Series
OFGM 129
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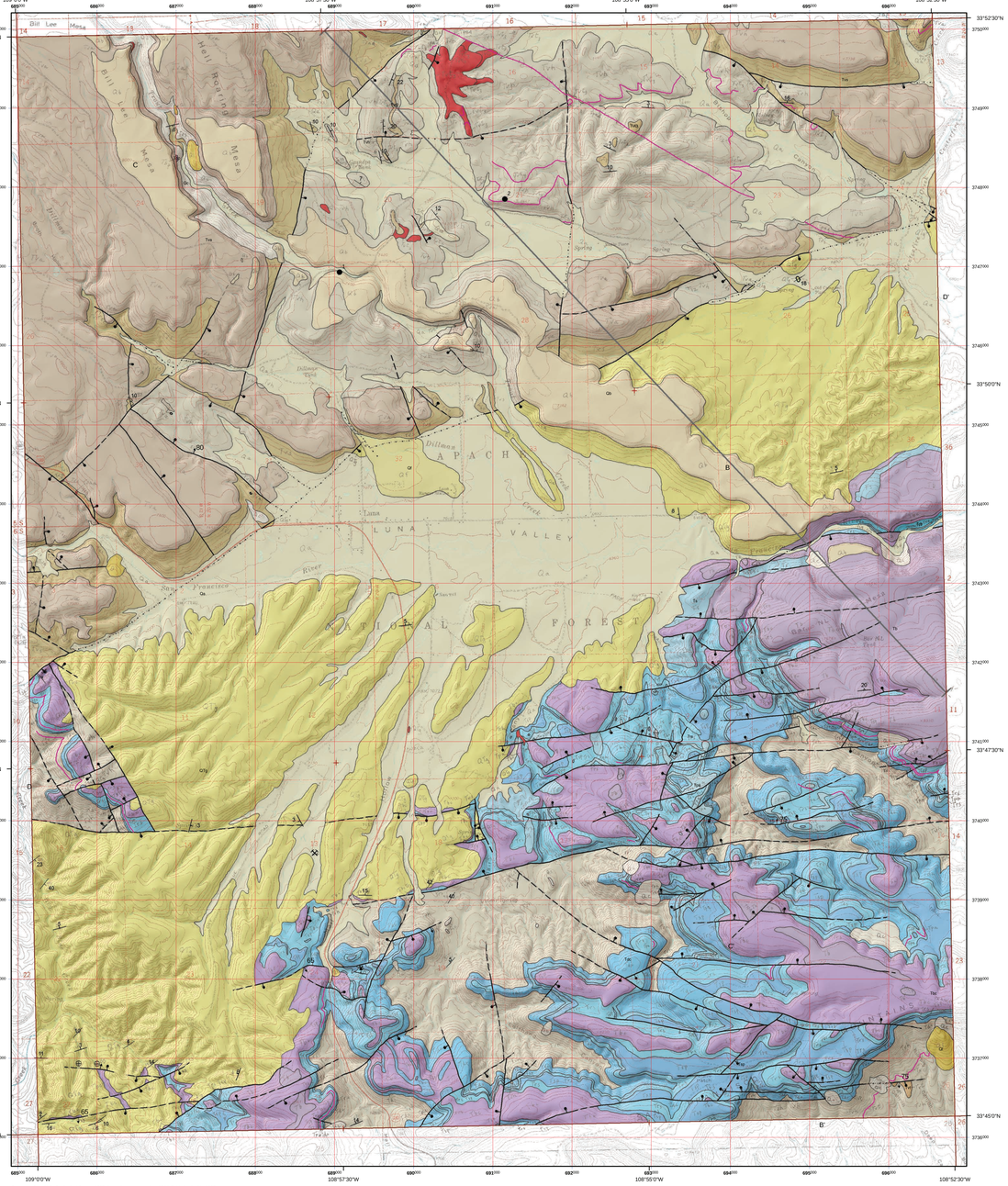

Base map from U.S. Geological Survey 1965, from photographs taken 1964; field checked in 1965.
1927 North American datum, UTM projection – zone 12N
1000-meter Universal Transverse Mercator grid, zone 12, shown in red

QUADRANGLE LOCATION

1:24,000

1 0 0.5 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0.5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

This draft geologic map is preliminary and will undergo revision. It was produced from either scans of hand-drafted originals or from digitally drafted original maps and figures using a wide variety of software, and is currently in cartographic production. It is being distributed in this draft form as part of the bureau's Open-file map series (OFGM), due to high demand for current geologic map data in these areas where STATEMAP quadrangles are located, and it is the bureau's policy to disseminate geologic data to the public as soon as possible.

After this map has undergone scientific peer review, editing, and final cartographic production adhering to bureau map standards, it will be released in our Geologic Map (GM) series. This final version will receive a new GM number and will supercede this preliminary open-file geologic map.

DRAFT

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New Mexico Bureau of Geology and Mineral Resources
Open-file Map Series
OFGM 129

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Geologic map of the Luna quadrangle, Catron County, New Mexico.

May 2006

by
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COMMENTS TO MAP USERS

A geologic map displays information on the distribution, nature, orientation, and age relationships of rock and deposits and the occurrence of structural features. Geologic and fault contacts are irregular surfaces that form boundaries between different types or ages of units. Data depicted on this geologic quadrangle map may be based on any of the following: reconnaissance field geologic mapping, compilation of published and unpublished work, and photogeologic interpretation. Locations of contacts are not surveyed, but are plotted by interpretation of the position of a given contact onto a topographic base map; therefore, the accuracy of contact locations depends on the scale of mapping and the interpretation of the geologist(s). Any enlargement of this map could cause misunderstanding in the detail of mapping and may result in erroneous interpretations. Site-specific conditions should be verified by detailed surface mapping or subsurface exploration. Topographic and cultural changes associated with recent development may not be shown.

Cross sections are constructed based upon the interpretations of the author made from geologic mapping, and available geophysical, and subsurface (drillhole) data. Cross-sections should be used as an aid to understanding the general geologic framework of the map area, and not be the sole source of information for use in locating or designing wells, buildings, roads, or other man-made structures.

The map has not been reviewed according to New Mexico Bureau of Geology and Mineral Resources standards. The contents of the report and map should not be considered final and complete until reviewed and published by the New Mexico Bureau of Geology and Mineral Resources. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the State of New Mexico, or the U.S. Government.

DESCRIPTION OF MAP UNITS

Qc Colluvium (Holocene)– Slope wash, talus and unspecified debris. 0–8 m thick

Qf Alluvial fan deposits (Holocene)–Boulder and gravel deposits at the mouths of tributary drainage. 040 m thick

Qa Stream alluvium (Holocene)– Sand, gravel, and boulder deposits along the San Francisco River valley and tributary valleys on flood plains and terraces as much as 25 m above stream level. 0-10 m thick

Qls Landslide deposits (Pleistocene and Holocene?)– Bedrock slide-blocks and related debris; mapped only along the south-facing slope of the San Francisco Mountains east of Burrow Canyon in the southwest corner of the quadrangle and along Trout Creek and the San Francisco River in the northwestern part of the quadrangle

Qb Basalt of Trout Creek (Pliocene)– Dark-gray, olivine basalt flows and minor reddishbrown scoria; basalt contains olivine crystals as much as 0.5 cm across in a fine-grained (aphanitic) groundmass of microlitic plagioclase and magnetite. Major flows cap Bill Lee and Helfroaring mesas, and appear to fill an ancestral Trout Creek, creating an inverted topography across the Luna graben, and deflecting the San Francisco River out of the graben to where it has become entrenched across the San Francisco Mountains A wholerock sample from Trout Creek area (northwest corner, Sec. 29, R. 20 W., T. 5 S.) gave a K-Ar age of 2.65 +1- 0. 10 m.y. (R.F.Marvin and others, 1987). O-60 m thick

QTg Gila Group, undivided (Oligocene?Pliocene)– Fine to coarsegrained fanglomerate and sandstone derived mainly from local bedrock; contains wellrounded to subangular basaltic, andesitic and rhyolitic welded tiff clasts. These basinfih1 deposits are confined mainly to the Luna graben, which trends northeast across the center of the quadrangle. Intertongues with Bearwallow Mountain Andesite along the San Francisco River near the eastern edge of the quadrangle. 0 to 200 m thick

SPEARS GROUP

Volcaniclastic sedimentary rocks interlayered with the volcanic rocks of the Mogollon and Datil Groups (Cather and others, 1994, p. 259266; Stratigraphic Nomenclature Chart inside back cover).

Tsu Upper Spears Group (O1ligocene)- Mainly reddish-brown to light-tan eolian sandstone interbedded between volcanic rocks of the Mogollon Group. Foreset laminations generally dip east to northeast; may contain numerous concretions 2-3 cm in diameter, more rarely to 12 cm. Zeolitic cement consists of dinotilolite and chabazite above Shelley Peak Tuff, but only clinotilolite below Shelley Peak (A.J.Gude III, oral commun., 1982). Oto as much as 70 m thick

Pueblo Creek Formation (late Eocene – early Oligocene)- Volcaniclastic sedimentary rocks interbedded with the volcanic rocks ofthe Datil Group.

Tvh Volcaniclastic Sedimentary Rocks of Heifer Basin (Oligocene)– Yellowishgray, conglomerate, sandstone, and interbedded light-gray to white tuff. Conglomerate clasts of weibrounded silicic to intermediate composition volcanic rocks are most common in lower part of sedimentary sequence, where interbeds are fluvial sandstone and tuff. Beds that directly overlie porphyritic andesite, Tla, are commonly green and well-iridurated. As much as 300 m thick

Tvs Volcaniclastic Sedimentary Rocks of Spur Lake Basin (Eocene Oligocene)– Lightgray to pale-brown, poorly indurated sandstone and conglomerate. Slopes generally covered with rubble and colluvium. An interbedded layer of ash-flow tuff a few meters thick, tuff of Bishop Peak, Tbpt, occurs about 3 5 meters below the top of this unit. Boulders of the tuff as much as a meter across, in the upper part of the conglomerate along Dillman Creek and on the east side of Hellroaring Mesa, indicate erosion of the tuff in nearby areas to the west before deposition of the overlying andesite lava flows, Tla. Conglomerate beds beneath the tuff, Tbpt, contain distinctive well-rounded clasts of Paleozoic limestone and pink Precambrian granitic gneiss, as well as Tertiary volcanic rocks. Thickness about 100 meters, or more; base not exposed. Named for Spur Lake Basin in Underwood Lake quadrangle to north. Correlates with "Volcaniclastic Rocks (Tpc) ofBull Basin Quadrangle to south (Ratté, 1989)

MOGOLLON GROUP

The Mogollon Group includes the volcanic rocks (ash-flow tuffs, and silicic to mafic lava flows) that unconformably underlie the volcaniclastic sedimentary rocks ofthe Gila Group, and unconformably overlie the Pueblo Park Formation of the Spears Group, Tmgu- Mogollon Group, undivided; shown only in cross section D-D'

Tba Bearwallow Mountain Andesite (late O1igoceneearly Miocene)– Dark gray to brownish gray, fine grained, vesicular lavaflows; contain small olivine crystals (1=5 mm), which are mostly altered to reddish-brown iddingsite. 0 to 300-400 m thick

Tbt Bloodgood Canyon Tuff (Oligocene)- Very light gray to pale pinkish-gray, densely welded to poorly welded, rhyolite ash-flow tuff (ignimbrite) contains 10- 30 percent phenocrysts, mainly perthitic sanidine (moonstone) and quartz crystals, a few to several mm across, and trace amounts of sodic plagioclase, sphene, biotite, pyroxene, and opaque oxides in a matrix of devitrified, flattened (eutaxitic) pumice fragments as much as several centimeters long, and very fine- grained devitrified glass shards. Thins from about 60 m in the San Francisco Mountains in the southeast part of the quadrangle to about 10 m along the San Francisco River at the east edge, relative to its source in the Bursum caldera in the Mogollon Mountains about 65 km southeast

Tst Shelley Peak Tuff (Oligocene)- Pale-red to light-gray, densely welded to poorly welded ash-flow tuff (ignimbrite). As much as 40% phenocrysts, 1-5 mm, mainly sodic plagioclase, and minor sanidine, biotite, opaque oxide and green pyroxene zircon is common in thin sections. 0-30 m thick

Tsa Squirrel Springs Canyon Andesite (Oligocene)- Porphyritic andesite lava flows contain phenocrysts of plagioclase as much as 12 mm long in a fine-grained groundmass of plagioclase, olivine and opaque oxide; olivine mostly altered to iddingsite. 0-10 m thick. Probably related to northwest trending, porphyritic andesite dikes, as much as 8 meters wide, Tpad, which cut older rocks in two localities: 1) dike in northeast part of quadrangle, west ofBishop Canyon, cuts volcaniclastic rocks ofHeiffer Basin, Tvh, and extends for about 6 km from the vicinity ofCenterfire Creek to the northern edge ofthe quadrangle. 2) short dike, about 200 meters long, cuts Davis Canyon Tuff, Tdc, and younger volcaniclastic rocks, Tvh, between Big Canyon and Trail Canyon in the east-central part of the quadrangle.

Tdt Davis Canyon Tuff (Oligocene)- Pale bluish-gray to light-gray, densely welded to poorly welded, rhyolitic ash-flow tiff; contains as much as 1 0 percent, or more, tiny (generally I mm or less) phenocrysts of sanidine, quartz and sodic plagioclase in a fine-grained devitrified groundmass. Light-gray to brown, eutaxitic (flattened and stretched) pumice fragments are as large as blocks 20 cm long, and may be distinctly lineated. Densely welded zones containing larger than usual phenocrysts may resemble Bloodgood Canyon Tuff Tht, requiring stratigraphic context for convincing correlation. Thins to west across quadrangle from about 100 m to less than about 20 m thick

DATIL GROUP

The Datil Group includes those volcanic rocks, mainly ash-flow tuffs (ignimbrites), that underlie the volcaniclastic sedimentary rocks ofthe upper Spears Group and are interlayered with the volcaniclastic rocks ofthe Pueblo Park Formation ofthe lower Spears Group. Except for the Bishop Peak Tuff', Datil Group ignimbrites are represented in this area by thin (0-a few m), discontinuous, non-welded tiffs, which generally are not identifiable, except where some ages correspond to specific tuffs ofthe Datil Group.

Tvt Datil Group Tuffs (upper Eocene – lower Oligocene)- As many as four tuffs at various stratigraphic levels are numbered sequentially from bottom (oldest) to top (youngest). The oldest tuff, Tvt1, contains numerous, pale-green pumice lapilli as much as 6-10 mm long and conspicuous small sanidine phenocrysts. Light-green tuffaceous sandstone beds alternate with lapilli tuffbeds at places.

Tvt2 is about 50 m stratigraphically above Tvt1; it is very light-gray (nearly white), laminated to cross-bedded to massive, 0-2 m thick, and contains small sanidine and biotite phenocrysts, and conspicuous volcanic lithic fragments, as much as 1 5 nun across, in a matrix of devitrified (zeolitized?) glass shards

Tvt3 is very light-gray (nearly white, phenocryst-poor, vitric (glassy tuff about 22 m above Tvt2. Biotite and sanidine concentrates from Tvt3 gave Eocene K-Ar radiometric ages of 36. 5 +1- 1 .3 m.y. and 34. 5 +1- 1 .2 m.y., respectively (age sample locality no. 2). An up-graded sanidine concentrate gave an age of 3 1 .9+1- 0.7 m.y. (R.F.Marvin, H.H.Mehnert, J.Gravies, and V. Merritt, U.S. Geological Survey, written communication, 1982).

Tvt4 is a light-tan tuff 0-3 m thick, and observed only in the north half of see. 21, T. 5 S., R. 20 W, about 30 meters above Tvt3.

Tla Andesite of Dry Leggett Canyon (Eocene)- Dark-colored, porphyritic andesite lava flows and dikes, Tvad, contain abundant, stubby, plagioclase and black pyroxene phenocrysts as much as 0.5 cm or larger. Vesicles common, and may contain brightgreen to yellow unidentified mineral material and calcite. "Luna" agate, which is much sought by mineral collectors and rock hounds, is common in vesicular zones in the andesite. Overlies Volcaniclastic Sedimentary Rocks of Spur Lake Basin, Tvs, and unconformably capped by Basalt of Trout Creek, Qb, north ofLuna graben. 0-85 m thick

Tbpt Tuff of Bishop Peak (Eocene)- Reddish-brown to reddish-orange, partially-welded to densely-welded ash-flow tuff contains small phenocrysts of biotite and sanidine, and conspicuous, small pumice blocks and lithic fragments.

Present in one small outcrop on the west side of Trout Creek, under Bill Lee Mesa, east of Hulse Cienega east of Bishop Canyon, and along S A Creek in the very northeast corner of the quadrangle. Biotite from a sample collected in the adjacent Underwood Lake quadrangle, to the north, gave a KAr age of 37. 1+I I .3 m.y. (Marvin, R.F., Mehnert, H.H., and E. Brandt, U. S. Geological Survey, written communication, 1982). Zero to a few meters thick 5

Geology Notes

The Luna 7 ½minute quadrangle was mapped by Tommy L. Finnell in 1981- 1982 and submitted for U.S.G.S. peer review in 1985, but the author died before his revisions could be completed. The manuscript has been resurrected with the addition of cross-sections, geologic notes, and up-dated Description of Map Units. The Luna Quadrangle is located in Catron County, in west-central New Mexico, adjacent to the Arizona-New Mexico State Line. U.S. Highway 180 enters the quadrangle from the south, and continues north to the village of Luna at the approximate center of the quadrangle. There the highway turns westward and leaves the quadrangle near the center of its western boundary, toward Alpine, Arizona, about 51miles northwest of Luna, fig. 1. The southeastern part of the Luna quadrangle includes the crest and northwest slopes of the San Francisco Mountains, where the highest point in the quadrangle is at an altitude of 8590 feet. The San Francisco River traverses the center of the quadrangle from west to east through the lush Luna valley. The northern half of the quadrangle consists of more subdued hills and mesas, and the whole is covered by a yellow pine forest, which is thickest on the slopes of the San Francisco Mountains and more open and park-like elsewhere. Luna was first settled in the winter of 1883 by a group of Mormon families that included 6 men, 6 women and 22 children, as chronicled in a book, "Do You Remember Luna100 years of Pioneer History", (Luna Ward, 1983). Today, Luna is a small ranching and logging community, and the location ofa U.S. ForestService District Ranger Station.

The Luna 7 ½ minute geologic quadrangleis in the northwestern part of the middle-Tertiary Mogollon-Datil volcanic field, in the transition zone between the Colorado Plateaus and the Basin and Range physiographic and structural provinces. The quadrangle can be separated into three geologic domains: 1) the southeastern part contains predominately volcanic rocks of the Mogollon Group, of Oligocene age, and consisting of ash flow tuffs (ignimbrites) that represent outflow from the Mogollon Mountains caldera complex about 30 mi. (50 km) to the southeast. These tuffs, Davis Canyon, Shelley Peak, and Bloodgood Canyon, commonly are separated by thin, volcaniclastic sandstone layers that are included in the upper Spears Group (Cather and others, 1994) and thin andesitic lava flows. 2) the northwestern part of the quadrangle consists mainly of older rocks, including Eocene lava flows of the Datil Group and a thick sequence of volcaniclastic rocks of the Pueblo Creek Formation (Ratte', 1989) of the lower Spears Group. The volcaniclastic rocks of Heifer Basin, named for the basin of that name in the Bull Basin Quadrangle to the south (Ratte', 1989) contain thin, discontinuous tuffs believed to be distal remnants of Datil Group ignimbrites. 3) the southeastern and northwestern segments of the quadrangle are separated by a northeast trending belt underlain by volcaniclastic rocks of the Gila Group, which comprise basin fill in the Luna graben. Of special note is the Quaternary basalt of Trout Creek, which represents inverted topography where it occupies ancestral Trout Creek, and which cuts across the Luna graben and diverts the river out of the graben.

The major structural features in the Luna quadrangle are the Luna graben, or half graben, which trends northeasterly across the center of the quadrangle and the Spur Lake fault zone, of more northerly trend, across the northwest part of the quadrangle. The Luna graben is bounded by the northeast-trending Luna fault on the north and a buried fault on the southeast. The graben is filled with at least 200 meters of Gila conglomerate, which is juxtaposed against Volcaniclastic Sedimentary Rocks of Spur Lake Basin, Tvs, and the overlying Andesite of Dry Leggett Canyon, Tla, indicating a stratigraphic displacement on the order of300-400 meters on the Luna fault. Gila conglomerate laps onto volcanic rocks of the Mogollon Group on the southeast side of the graben (cross section A.A'), which supports the growthfault and half-graben interpretation of the Luna graben The northeast-trending Spur Lake fault, in the northwestern part of the quadrangle, displaces the older volcanic and volcaniclastic rock sequences on the west side of the fault at least 400 feet(122m to 700 feet (213 meters) down on the east side of the fault (cross sections AA' and C-C'). To the north, it continues as the Fox Mountain fault of Chamberlin (1944); to the south it converges with the Luna fault.
The rocks in the San Francisco Mountains structural block, on the south side of the Luna graben in the southeast part of the quadrangle, are broken by a family of eastwest4rending normal faults having offsets which range from a few meters to 50-100 meters. They form an en-echelon pattern of minor horsts and grabens, which are concentrated between the two major northeast4rending Spur Lake and San Francisco Mountains faults, (fig. 2), which can be interpreted as tension fractures produced by east west compression, or, more likely, by transtension related to a northeast-southwest shear couple resulting in an unknown amount of dextral (right4lateral) strike slip. On the bounding faults (Fig. 2). In regional context, the Luna quadrangle must be considered to be within the N52E, 50 km. wide Jemez magmatic zone, also commonly referred to as the Jemez lineament or plain Jemez zone (fig. 3) (Aldrich and Laughlin, 1984; Aldrich, et. al., 1986; Karlstrom et. al., 2004, p. 1 5, figs. 2, 1 1). The Jemez zone is generally accepted as a somewhat loosely defined belt of late Cenozoic, mainly basaltic to alkali basaltic, eruptive centers, which more or less coincides with what is considered to be "perhaps the best candidate for a lithospheric suture zone in New Mexico, based on several indicators of possible Paleoproterozoic tectonic boundaries"(Karlstrom et. al., 2004). Any aspects of this ancient structure in the Luna quadrangle are occult, but the location of the quadrangle within the Jemez magmatic zone is supported by the presence of the2.5 Ma basalt of Trout Creek and numerous low volume alkali basalt flows of Miocene to Holocene age in adjacent quadrangles along the Morenci lineament (Ratté, 1989, 2001; Ratté and others, 1994). This "bleeding" of late Cenozoic basaltic magmas over a somewhat more extensive area than cited by Chapin and others, (2005) brings to question any precise distinction between the Jemez and Morenci lineaments, or more specifically, magmatic zones. The overlapping of Oligocene basaltic andesite and younger basaltic volcanism along the Jemez and Morenci zones may indicate a progressive migration of mafic magmas from east to west after the mid-Tertiary "ignimbrite flare-up" as tentatively interpreted here from the age distribution diagrams in Chapin and others, 2005, (figs. 1F-1L).

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