Sue Hirschfeld

North Table Mountain Field Trip for Colorado Scientific Society

April 2005 – By Harald Drewes

Background – Table Mountain (NTM) lies immediately NE of downtown Golden, Colorado and N of the Coors Brewery. It is the northernmost of three hills in the Denver area that lie E of the Rocky Mountain Front Range and the Dakota Hogback.

The main geologic features of NTM have been known since the early surveys of the West (LeConte, 1868; Hayden, 1873), and have been frequently studied by the staff and students of the Colorado School of Mines. Additionally, Van Horn (1972) mapped NTM, part of South Table Mountain (STM) and the Ralston "Dike" area, and Scott (1976) mapped the remainder of STM and Green Mountain (GM). The objectives of these mapping studies focused on stratigraphy, paleontology, engineering geology and surficial deposits. My contributions focused on structurally geology and petrography. A few adjustments were also made to the maps.

The plan of this field trip is to cross the western part of the NTM mesa. We will ascend by trail and an old quarry haulage road on the west flank and descend on or near a service road for a communications facility on the NW flank. The area of that facility should make a good lunch stop. Meet at the Jefferson County parking lot on the W side of the mesa (from CO Hwy. 93 take Pine Ridge Road E one block, then turn onto Wyoming Street). We'll arrange a car shuttle and end up at the Jeffco Open Space gate on 58th St., about 0.5 km E of CO Hwy. 93.W

On this field trip we'll see some new (?) geologic features, and "arm-wave" in some others, particularly those on STM and the Ralston "Dike" area. We'll see faults, open folds, a tumulus ridge, a newly identified lava flow, and a low dome on STM.

The lava flows are intercalated in the Paleocene part of the Denver Formation (TKd). The low area W of Hwy. 93 is chiefly underlain by alluvial terrace deposits, beneath which is the Late Cretaceous Pierre Formation. This formation is mainly made up of mudstone that is more than 6,000 ft thick. The ridge W of the lowland is underlain by the Late Cretaceous Dakota Group, made up mainly of moderately indurated sandstone, a few hundred of feet thick. Other Cretaceous formations are of little consequence on this trip. The lava flows are 63-64 my old (Obradovich, 2002).

The Golden Fault lies W of the mesa and mostly also W of the highway. It was active through Late Late Cretaceous to Early Paleocene (Green Mountain, member 4) time, probably peaking toward the end of this time span, to judge from the age of the coarsest and thickest piedmont deposits. One shred of evidence suggests that locally there was renewed movement on the fault during Late Pleistocene time. While the fault and its major branches followed the steeply inclined Pierre Formation in this area, in cuts gradually down-section to the S, with the W block having moved up relative to the E block.

Trip Description – Leave parking lot on trail to a large water tank and continue upward S of the tank and then N onto old haulage road to a quarry. Ascend the road a few hundred meters.

STOP 1: Alongside the road are large blocks of a lava flow, probably not from the overlying end of a channel flow 1; it is a good place to get acquainted with the shoshonite porphyry. Phenocrysts make up 15-20% of the rock and are of 1-4 mm size. These are set in a mostly blocky groundmass with minor felty overtones, and commonly in the 0.2-0.5 mm size. The major minerals are andesine plagioclase (near white and tabular), augite pyroxene (black and tabular) and olivine (greenish black and somewhat rounded-blocky). Accessory minerals include magnetite and apatite. Additionally, most rocks contain interstitial orthoclase and biotite. Secondary minerals include alteration products and in some rocks also zeolites. Shoshonite is a fancy name for potassium-rich basalt.

The lava flows are numbered, in rising sequence, by Van Horn (1957). His scheme is followed in this study; thereby the newly identified flow gains the label of flow 2 and the mesa-capping flows are now numbers 3 and 4. From limited petrographic evidence, flow 1 may comprise two kinds, the older of which is provisionally called flow 1a. More about this is offered at stop 9. In hand specimen all flows and intrusive rocks look alike. Microscopic study, however, shows subtle differences in texture or composition.

Near the water tank, below, and on our way upward to the next stop we pass small outcrops of the Denver Formation, a weakly indurated siltstone and sandstone, as well as some mudstone and pebble conglomerate. A tuffaceous component is probably present in the nearly white beds. All coarse clasts are andesite except near the lava flows where some shoshonite porphyry clasts are also present. Elsewhere some lenses of cobble conglomerate and even fewer of boulder conglomerate are also found, but they make up less than 5% of the formation in this area.

Fresh shoshonite porphyry blocks of lava flow 4 are present at this site, as they are at many of the foundations of the power line that crosses NTM. The upper part of flow 4 has almost everywhere (or everywhere?) been eroded. However, a red oxidized amygdular zone at the top of flow 3 provides an example of what was eroded. Inasmuch as this upper zone of flow 3 is easily eroded relative to the thicker lower columnar jointed part of the flow, it underlies a topographic bench. Pick out this bench beneath us and project it ahead of our route so far. Evidence of the upper zone of flow 3 may be harder to find on north-facing slopes on which a thicker cover of colluvium is present, so we may head to a W facing slope.

To the NW beyond the highway are some low knolls and the Ralston "Dike", or more accurately, the Ralston Plug, since at the present level of exposure the body is not tabular, but elliptical, 1 km by 2 km. Shoshonite porphyry intrusive rocks underlie these knolls and the high hill at the active quarry of the Asphalt Paving Company, and among these intrusive rocks are the sources of the lava flows. We'll return to these features at stop 7. We now head NE, past a dry (?) stock pond, and to or just beyond the power line.

STOP 6: A low ridge runs NE and below it is a slight bench that has the rubble of a flow top. The rock of the cuesta is herein seen to be flow 4, and the detritus of flow top material marks the top of flow 3. In other words, flow 4 has been eroded back from the edge of the mesa. This situation continues to the NE end of NTM, and for most of this stretch the cliff is made up of a single flow, number 3. Now head NW to a high point along the mesa edge.

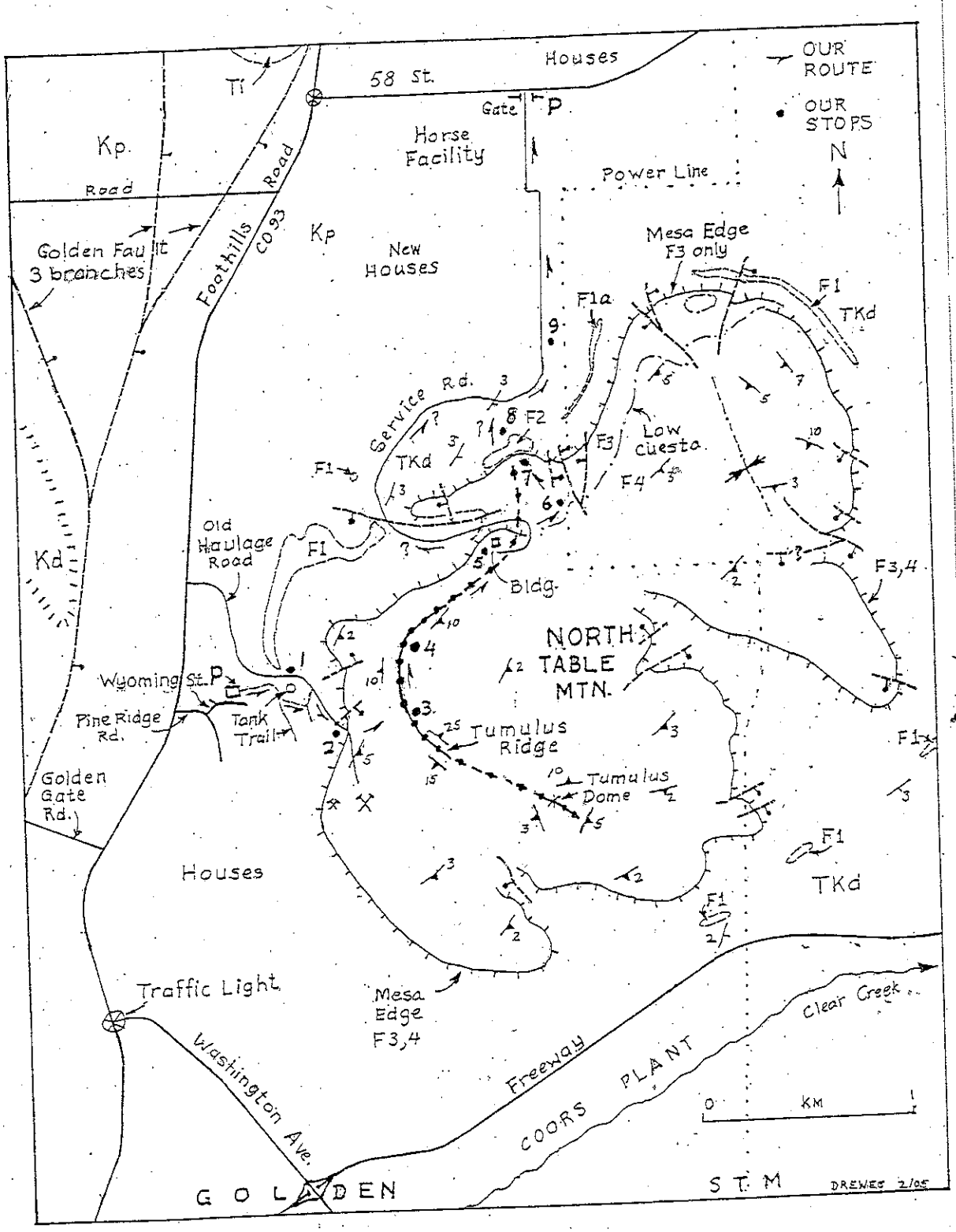
STOP 7: The mesa edge here is developed in the lower part of flow 3, forming a cliff about 10 m thick. A bench on which outcrops are poor lies beneath the low cliff. Small rounded clasts (worn or weathered round ?) of pebble size are sparsely present in the colluvium on the bench. The shoshonite body below appears to be another unit than the previously known flows, and the abrupt upward ending of the zeolitized rock may be the sign of a disconformity. Should the rounded fragments have been worn round, they may be a remnant of a thin clastic deposit along this disconformity.

Before leaving this site let's return to the review of the intrusive rocks West of highway 93 that was started at stop 5. Note again to the NW the distant highest hill with the quarry. It is underlain by a rim of more resistant or harder rocks and a core of weaker ones. Fresh rim rocks are a medium gray color, whereas those of the core are browner even where well exposed in the quarry. The dominant jointing in the rim rock strikes ENE and dips steeply, whereas the main joints of the core are gently inward dipping. The core area rocks are so weak that a basin has developed on them. With a little help from man, the basin now contains a reservoir. What would the seeming lack of a recognizable contact between these rock phases imply? Petrographic study also shows that there is a subtle difference between the two rock types. Altered ("baked") Pierre Shale host rocks form a belt about 10 m wide. The Ralston Plug is seen to be a composite intrusive body, and one up which a large amount of magma passed, bringing with it sufficient heat to alter the host rock.

In the area between the composite plug and our stop 7 site are many small pods, dikes and sills (?) of shoshonite porphyry. A small plug forms the hill just NW of the junction of highway 93 and 58th Street. No signs of alteration are found in the adjacent Pierre Shale. A single specimen from the SE border of this plug has an anomalously all-felty groundmass texture rather than the normal blocky texture with just a hint of the felty. At stop 8 we'll return to this texture variation. This small plug is believed to have reached the surface. It also may be a two-phased vent. Most of the other small intrusive bodies probably did not reach the surface, although two bodies W and NW of the small plug may have done so. The small plug without altered surrounding host rocks appears to have had a small volume of magma pass through it, thus bringing less heat. Which of the plugs are linked to which flows based on this observation alone?

Two options are now offered to get down the mesa flank. Those able to head directly down the slope below site 7 will head down just W of the big cliff below. The other option is to backtrack a bit and head down the service road of the communications facility of stop 5. While this second option is a longer way, there will be no delay in pausing at stop 8, and a few key features of the stop 8 site can be explained from the road. In any case, all will rejoin on the service road below the large cliff.

STOP 8: Here the contact between the shoshonite porphyry and TKd is very steep, yet there is no sign of shearing. To the E the body of lava is thicker than to the W. On neither side of the steep contact segment does the body extend far from this large outcrop. The rock is much zeolitized and probably also has many veinlets and pockets of calcite; these are particularly abundant near the steep contact. The appearance of this body is that of a lens, or channel-filled lava flow and the step up to the W suggests that the channel had a stream terrace. The lava filled the lowest part of the channel and spilled over onto the adjacent terrace. The abundant secondary minerals likely reflect the abundance of water in the channel or its underlying sediments. The position of this channel flow immediately beneath flow 3 and not as low down as the channel flows 1, an outcrop of which is found on the E side of the gulley a few hundred meters to the E, indicates that it is a newly identified flow, herein labeled number 2.


OUR ROUTE
OUR STOPS
N
Houses
58 St.
Gate
P
Ti
Kp
Road
Horse Facility
Power Line
Foothills Road
C093
Kp
New Houses
Golden Fault 3 branches
Mesa Edge F3 only
F1
TKd
F1a
9
Service Rd.
3
8
F2
F3
Low Cuesta
F4
TKd
F1
6
Old Haulage Road
F1
Kd
5
Bldg.
F3,4
NORTH TABLE MTN.
Wyoming St.
P
Pine Ridge Rd.
Tank Trail
1
2
3
4
Tumulus Ridge
Tumulus Dome
F1
Golden Gate Rd.
Houses
TKd
F1
Traffic Light
Mesa Edge F3,4
Clear Creek
Freeway
COORS PLANT
Washington Ave.
0
KM
1
GOLDEN
STM
DREWES 2/05