From: Paul Murphey [pmurphey@swca.com]
Sent: Wednesday, October 31, 2007 12:13 PM
To: Keith Burron
Cc: Paul Murphey
Subject: Comments and Geologic Map

Keith,

Attached are 4 files. These include the comments I prepared for the hearing on October 24 2007, and 3 scans of the geologic map of the Kinney Rim 30 x 60 Quadrangle. As can be clearly seen upon examination of the geologic map, the geographic distribution of the Adobe Town Member of the Washakie Formation (Twka) does not correspond to the proposed boundaries of the rare and uncommon area as presently defined. The reference for the geologic map is as follows:

Roehler, H.W., 1985, Geologic map of the Kinney Rim 30 x 60 Minute Quadrangle, Wyoming and Colorado: *U.S. Geological Survey Miscellaneous Investigations Series Map* I-1615 (scale 1:100,000).

Please let me know if I can of further assistance, Paul

Paul C. Murphey, Ph.D.
Principal Investigator, Paleontology
SWCA Environmental Consultants
Denver Office

295 Interlocken Boulevard, Suite 300
Broomfield, CO 80021
Tel. 303.514.1095; 303.487.1183
Fax. 760-758-4019; 303.487.1245
www.swca.com
pmurphey@swca.com

Statement Read by Paul C. Murphey at the Adobe Town Hearing, October 24, 2007

My name is Paul C. Murphey, I'm am with SWCA Environmental Consultants. The operators have asked me to attend this hearing and prepare a statement regarding the paleontological resources (or fossils) present within the area that is the subject of this hearing, and place these resources in a scientific context, discuss their distribution, and provide a summary description of paleontological mitigation measures typically implemented for surface disturbing projects in paleontologically sensitive geographic areas and geologic units.

My background: I earned Masters and Doctoral degrees in Geological Sciences with emphases in paleontology from the University of Colorado at Boulder. I've been working in the field of paleontology since 1992. My past professional appointments include Collections Manager of Paleontology, Geology and Osteology at the University of Colorado Museum of Natural History, Instructor in the Museum and Field Studies Program at the University of Colorado at Boulder, Member of the Graduate Faculty at the University of Colorado Boulder, Special Appointee at DOE's Argonne National Laboratory, and Associate Curator of Paleontology and Associate Director of PaleoServices at the San Diego Natural History Museum, where I am currently a Research Associate. Additionally, I have worked as a paleontological consultant for hundreds of paleontological resource management projects throughout the western United States on Federal, State and Private lands, and am currently the Principal Investigator for the Paleontology Program at SWCA Environmental Consultants.

I have completed a lot of paleontological and stratigraphic field work in the Washakie Formation of the Washakie Basin, as well as other Eocene-age sedimentary units in the Bridger (Green River), Sand Wash, Piceance Creek, and Uinta basins. My current field research projects are focused on better documenting and understanding the mammalian biochronology across the Bridgerian-Uintan NALMA boundary. One of the few places where this transitional boundary occurs is actually located in the Washakie Basin within strata of the Adobe Town Member of the Washakie Formation. This makes the area of concern of particular scientific importance.

The Washakie Formation is the bedrock geologic unit that is exposed within the area of concern. It is known to be paleontologically sensitive, and has been assigned the highest sensitivity level by the Wyoming BLM (PFYC Class 5). As such, surface disturbing projects that effect the Washakie Formation, as with other Class 5 geologic units in the area and elsewhere in Wyoming, trigger certain mitigation requirements in order to comply with the BLM's paleontological resource management guidelines. I'll talk more about mitigation later. However, in terms of the "rare and uncommon designation" and the boundaries of the proposed area I have seen, there is no relationship between these boundaries and the distribution of paleontological resources. Thus, the same argument for a "rare and uncommon" designation could be applied using the same paleontological sensitivity criteria not only to the entire Adobe Town Member of the Washakie Formation which is a much larger geographic area, but to similar formations in terms of general age and fossil content occupying large areas of the greater Green River, Wind

River, Bighorn, and Powder River basins. These include the Wasatch, Green River (some members), Bridger, Wind River, White River, Willwood, and others. Furthermore, the area delineated for the "rare and uncommon" designation preferentially excludes rocks in the lower part of the Adobe Town Member, which are of particular scientific relevance to the Bridgerian-Uintan faunal transition.

The fossils of the Washakie Formation and other related Eocene-age strata in the intermontane basins of the Rocky Mountains have been the subject of paleontological investigation and inquiry for over 130 years. As such, the area has historic importance to the discipline of paleontology in addition to the scientific importance of its fossils. The formation preserves primarily fossil reptiles (mostly turtles, crocodilians, lizards and snakes) and a diversity of mammals including brontotheres, uintatheres, rhinos, primates, and many others. These long extinct animals lived in the area during the middle part of the Eocene Epoch, roughly 44-47 Ma, and provide a critically important source of data for evolutionary and paleoecological inquiries into this important time period. Well-preserved fossil wood is also locally abundant. The fossils of the Washakie Formation are not uniformly distributed throughout the area, but generally occur in areas of topographic relief with little vegetation and good bedrock exposure such as badlands. Within badland exposures, fossils are also typically restricted to comparatively thin rock strata. Although in depth paleontological work has been conducted in the area for years, most recently by Bill Turnbull and Bob McCarroll of the Field Museum of Natural History in Chicago (up until the mid 1990's), additional fossils from both unknown and previously recorded fossil localities have undoubtedly locally eroded out of the rock, either completely or partially, since these workers stopped working in the area. Indeed, this was the case for the fossils discovered during the Cherokee West paleontological survey in 2006 and is definitely the case elsewhere in the basin. The BLM recently contracted with a paleontologist to survey several sections in the Haystack Mountain area in order to document and collect fossils, and provide and idea of the paleontological richness of the area. This indicates that the distribution and abundance of fossil localities within the Washakie Formation in the area is not well known at present.

As stated previously, surface disturbing projects including oil and gas development and mining in paleontologically sensitive areas trigger paleontological mitigation requirements by Federal agencies. Although mitigation strategies can be complex, the general intent is to locate surface fossils and evidence of subsurface fossils, collect and document them, remove them from the area so they won't be destroyed by surface disturbing activities, and transfer them to a public museum for curation and permanent storage where they will be available for scientific research, education and display.

Now, before I discuss mitigation further, I need to point out that once eroded out of the rock in which they were preserved, fossils are subject to a number of destructive forces that eventually lead to their total destruction by breakage and fragmentation. These include the process of erosion itself, secondary weathering, trampling by wildlife, livestock, and human activities; and unlawful vandalism and poaching. My contention is that paleontological mitigation creates a beneficial impact because it results in the discovery and documentation of fossils that may otherwise never have been discovered

and would likely have been destroyed by the aforementioned processes. Thus, from my perspective as a paleontologist, I, and many others, would much prefer to have these fossils saved and housed in a public museum for perpetuity. In short, if properly implemented both by the BLM and consultants, Federal guidelines for mitigation of paleontological resources that are triggered by surface disturbing actions benefit the science of paleontology.

Mitigation measures for paleontological resources consists of the following general steps:

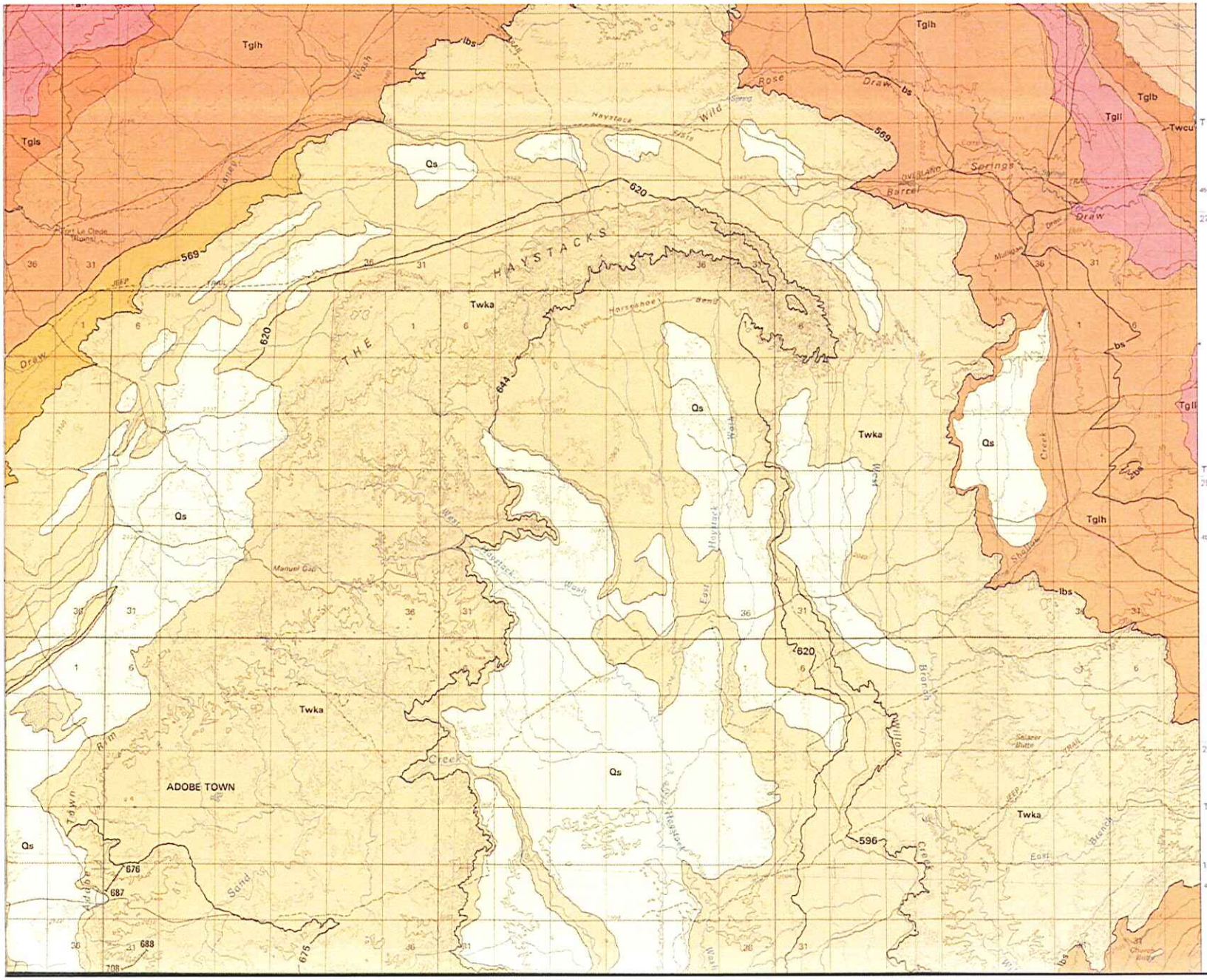
A. Data Acquisition and Synthesis
   1) Scientific and gray literature searches in order to evaluate the sensitivity of a given project area, determine known fossil types, and determine if previously recorded paleontological collecting localities occur within a given project area.
   2) Museum and agency record searches in order to evaluate the sensitivity of a given project area, determine known fossil types, and determine if previously recorded paleontological collecting localities occur within a given project area.
   3) Reviews of geologic maps and aerial photos of project areas in order to delineate areas of inclusion for field surveys.
   4) Develop research questions (known as a research design) for the project.
   5) Logistical planning for the field survey itself, including permitting and coordination with agencies and museums.

B. Field Survey
   1. Systematically prospect the surface of the study area, examining rock outcrops and anthills for fossils.
   2. Determine significance of fossils typically on the basis of identifiability, collect the fossils using the appropriate salvage technique, collect associated data.
   3. Place the fossil localities in stratigraphic context using measured stratigraphic sections.
   4. Unanticipated discoveries such as unusually large fossils or large concentrations of microfossils may be recommended for avoidance or later mitigation.

C. Analysis, Reporting and Museum Curation
   1. Transport all fossils and associated data to a paleontological laboratory.
   2. Prepare fossils using archival materials (matrix removal, stabilization and application of chemical consolidants, gluing of fragmented remains, constructing of supporting cradle as appropriate).
   3. Identify fossils
   4. Compile specimen and locality data
   5. Prepare Final Project report using (and hopefully exceeding) agency guidelines (includes a catalogue of specimen and locality data; locality forms, maps and photographs; prepare stratigraphic section with fossil localities positioned on it; prepare report text with discussion of fossils and their significance in the context of the research questions set forth in

the research design; include discussion of mitigation methods and procedures, personnel involved, etc.). Reports with complete data are submitted to the agencies; and without locality data are provided to project owners.

6. Transport all fossils, along with copies of report, field notes, field maps, preparation techniques employed, and any other associated documentation to the paleontological curation facility. These facilities assess curation fees upon receipt of fossil collections.
7. At the end of the calendar year, submit annual report for the paleontological permit under which the project was conducted to each agency involved in the project.



Unconformity
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Upper Cretaceou
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Kbls
Kbx

DESCRIPTI

Qs — SAND DUNES (HOLOCENE AND (OR
desert vegetation. 0–10 m thick

Tbp — BROWNS PARK FORMATION (MIOC
grained, tuffaceous sandstone and
gray and red mudstone. 0–190 m

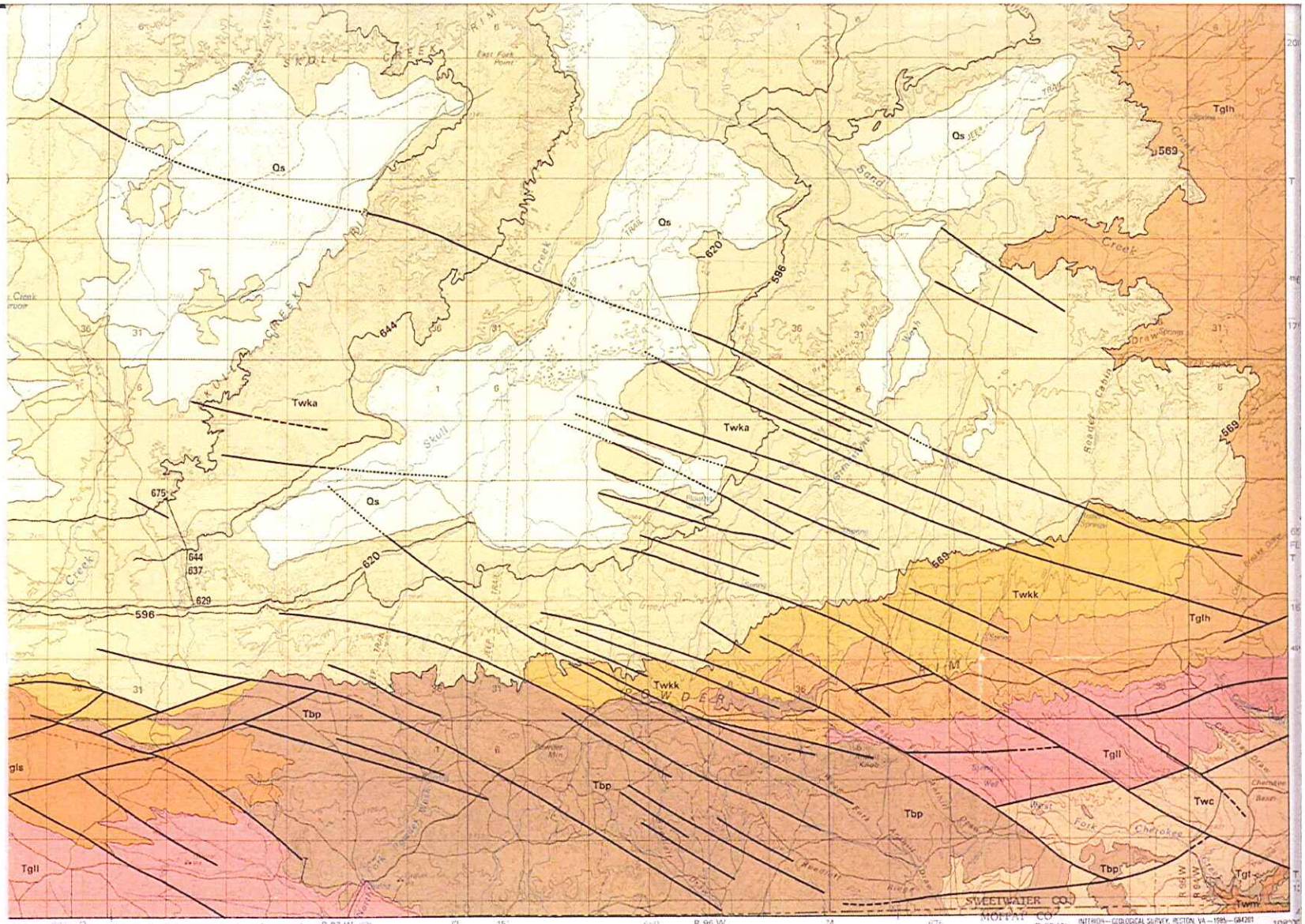
Tb — BISHOP CONGLOMERATE (OLIGOCI
subangular to subrounded boulders,
chert, sandstone, and limestone. 0–

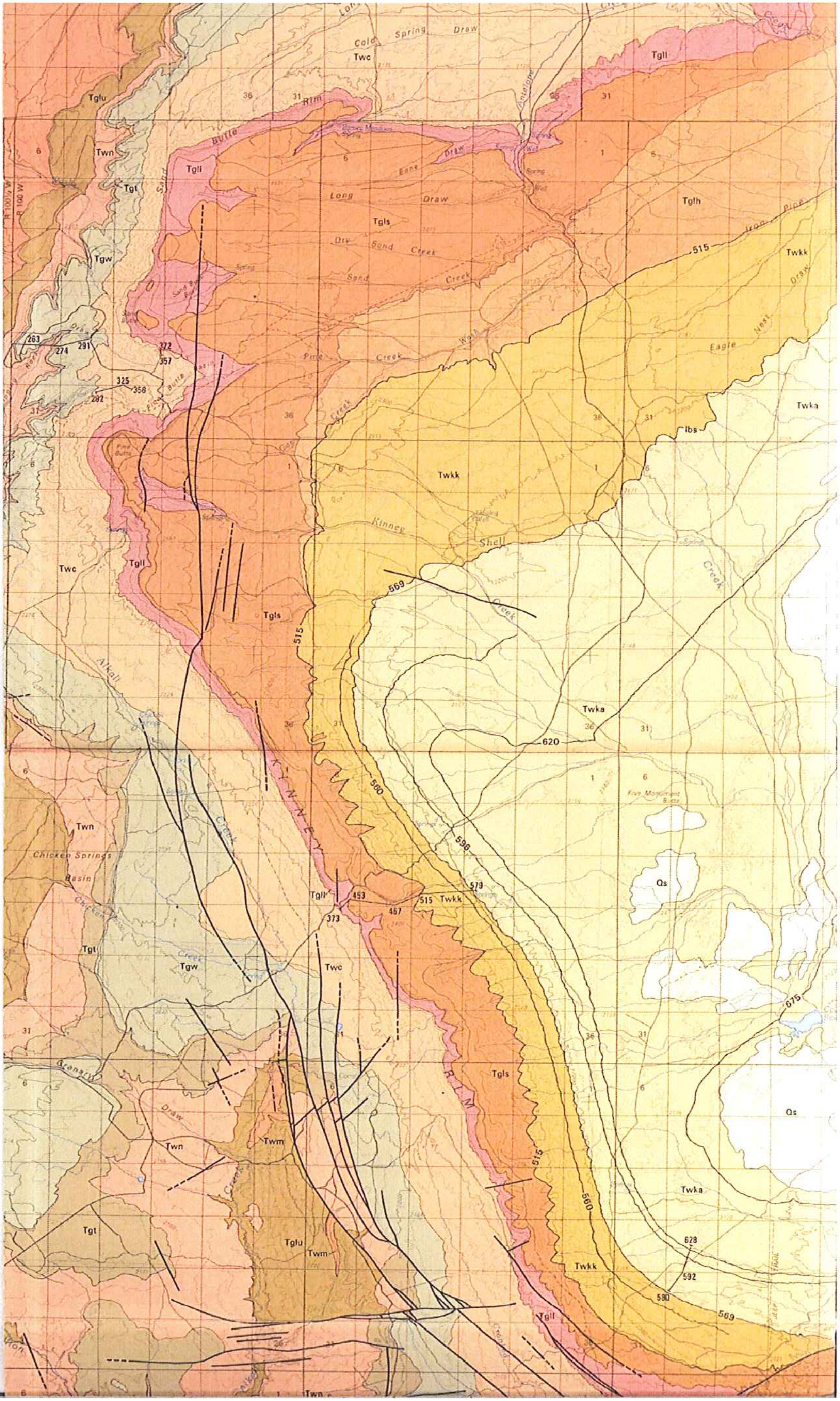
Twka — WASHAKIE FORMATION (EOCENE)
Adobe Town Member—Interbedded gr
tuffaceous sandstone, gray and re
variegated mudstone, brown and gra
blue-green, and gray tuff, and tan

675 — Marker bed 675
644 — Marker bed 644—Upper red mark
620 — Marker bed 620—White tuff
596 — Marker bed 596—Middle red mark
569 — Marker bed 569
lbs — Lower brown sandstone

Twkk — Kinney Rim Member—Interbedded gra
green, very fine to medium-grained s
tuff, tan-gray and gray-brown limest
limestone, and thin, lenticular congl

560 — Marker bed 560—Lower red mark


SKULL CREEK RIM
Qs
Twka
Tglh
Tgll
Tbp
Twkk
Twc
Tgt
644
637
629
620
596
675
569
SWEETWATER CO
MOFFAT CO
R 97 W
R 96 W
R 95 W
R 94 W
15 KILOMETERS
5 MILES
WYOMING
QUADRANGLE LOCATION
Geology mapped in 1968–75



Cold Spring Draw
Twc
Tgll
Tglu
Twn
Tgt
Sand Butte Rim
Long Draw
Tgls
Dry Sand Creek
Tglh
Twkk
515
Tgw
Pine Creek
Eagle Nest Draw
Twka
Ibs
Kinney
Shell Creek
569
Alkali
KINNEY RIM
560
620
Five Monument Butte
596
Chicken Springs Basin
Twn
579
453
373
467
Qs
675
Tgt
Twc
Twm
Tglu
Granary Draw
628
592
580
R 100 W