

Geologic Map of the Truchas Quadrangle, Rio Arriba County, New Mexico

By

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May, 2004

**New Mexico Bureau of Geology and Mineral Resources
*Open-file Digital Geologic Map OF-GM 84***

Scale 1:24,000

This work was supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program (STATEMAP) under USGS Cooperative Agreement 06HQPA0003 and the New Mexico Bureau of Geology and Mineral Resources.



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Report on the Geology of the Truchas 7.5' Quadrangle, New Mexico

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May 2004

This report summarizes significant results of geologic mapping of the Truchas quadrangle during 2002-2004. An important consideration in using this map is that geologic relationships are poorly exposed, and therefore poorly known, over most of the quadrangle. Geologic units are mapped mostly on the basis of float over the eastern two-thirds of the quadrangle because of high vegetation density and, especially, lack of consolidation of basin-fill sediment and gus weathering of Precambrian rocks.

Precambrian rock units

Basement rocks of the Truchas area represent a complex suite of mixed supracrustal rocks dominated by amphibolite and biotite schist. Discrete beds of muscovite schist are intimately intercalated with amphibolite and biotite schist. Supracrustal rocks contain a foliation that generally dips moderately-to-gently toward the South. The main foliation is typically defined by biotite or muscovite and is axial planar to isoclinal, shallowly south-plunging folds. Fold closures in the area are exceptionally rare, perhaps due to poor exposure and the absence of reliable marker units to define the fold hinges. These rocks likely represent a mixture of protoliths including both sedimentary and mafic volcanic rocks.

Paleoproterozoic supracrustal rocks were intruded by at least three igneous units, including pCqm, pCbg, and pCgm. Clear crosscutting relationships between pCgm and older units are abundant where pegmatite dikes are exposed. The relative timing between pCqm and pCbg remains speculative. Unit pCbg is mapped as a more tabular unit that is subparallel to the main foliation and is not observed to cross cut pCqm. Unit pCqm represents the most abundant rock type by volume in the area. This granite body locally truncates supracrustal compositional layering and foliation suggesting emplacement following development of the main foliation. The foliation preserved in pCqm is subparallel to the foliation measured in supracrustal rocks perhaps an indication that emplacement of this pluton was concurrent with development of the regional foliation.

Basin-fill strata

Stratigraphic nomenclature and definition of map units

The Tesuque Formation represents Miocene rift-basin filling sedimentary strata in the Truchas quadrangle. Although a detailed stratigraphy of the Tesuque Formation has emerged in recent years from mapping in the well-exposed badlands that dominant the Española basin landscape, poor exposures in the Truchas quadrangle preclude anything more than generalized mapping of units. Poor exposure largely results from the

unconsolidated nature of most of the Tesuque Formation in the quadrangle, such that it does not crop out at all on forested hillslopes.

Gravel and conglomerate beds are present throughout the Tesuque Formation and dominate upper stratigraphic levels and more easterly occurrences of the formation. Provenance-sensitive gravel-clast assemblages are notable in float, even where strata are not exposed. The appended table contains clast-count data collected throughout the quadrangle. These data illustrate the compositional variability of Tesuque Formation sediments.

Two, markedly different clast assemblages allow division of the Tesuque Formation into two map units.

- In the northern part of the quadrangle, Tesuque Formation gravel layers consist of nearly equal proportions of Precambrian quartzite cobbles and clasts of Pennsylvanian sedimentary rocks. In some layers, volcanic pebbles and cobbles are also present within these strata. These strata correlate to the informal Dixon member of Steinpress (1980), which was also mapped on the adjacent Trampas quadrangle by Bauer and Helper (1994). Clast composition of the younger Dixon member closely resembles that of the Cejita Member of Manley (1977). The Cejita Member is overall coarser grained than the Dixon member but this distinction is not possible to make on most poorly exposed hillslopes in the Truchas quadrangle. The Ojo Caliente Sandstone Member separates the Cejita and Dixon Members to the north and west but is absent in the Truchas quadrangle, which further complicates the ability to distinguish the two coarse members. All of the gravelly strata of mixed quartzite-Pennsylvanian-rock provenance are mapped as Dixon member, although it is possible that unrecognized down-faulted blocks exposing Cejita Member may exist on the quadrangle.
- In the southern quadrangle, gravel clasts are a mix of Precambrian quartzite and granitic rock types, with less common amphibolite, schist, vein quartz, and sparse Pennsylvanian rocks. Cobble counts and qualitative observations during mapping traverses indicate that the quartzite content generally increases upsection and to the east, along with a gradual increase in cobble and boulder size and decrease in sand and silt layers. Overall poor exposure precludes mapping distinct units on the basis of grain size variations or clast composition as has been accomplished in some adjacent quadrangles. All quartzitic-arkosic strata are, therefore, mapped as a single unit. Quartzite comprises 40-70% of most gravel exposures in the western quadrangle from Cordova northward to the ridges south of Ojo Sarco. These beds are particularly well exposed along highway 76 north of Truchas and in badlands west of Truchas. Presumed younger strata underlying pine-forested ridges in the eastern part of the quadrangle are nearly entirely quartzite. The best local exposure of this coarse quartzite-rich interval is on the adjacent El Valle quadrangle at Vallecitos.

Provenance of sedimentary strata

The two map units of the Tesuque Formation represent different sediment-source areas. The Dixon member records one or more west flowing streams that drain Pennsylvanian

bedrock east of the Picuris-Pecos fault. Quartzite clasts in the Dixon member are contributed from south-flowing tributaries draining the Picuris Mountains or streams draining northwestward from the Truchas Peaks. The quartzitic-arkosic strata record streams draining from the Truchas Peaks and across the northern end of the Santa Fe Range. Streams draining only the Truchas Peaks area deposited Tesuque Formation consisting entirely of quartzite.

Trace quantities of Pennsylvanian clasts are found in the quartzitic-arkosic facies of the Tesuque Formation, primarily south of Truchas. These relatively older layers of the Tesuque Formation are likely receiving Pennsylvanian clasts from outcrops south of the Truchas Peaks. The most notable Pennsylvanian clasts in the quartzitic-arkosic facies are south of the Rio Quemado near Cordova. Here, thick, notably redder, trough-cross-bedded pebbly sandstone layers are distinct from the more typical tan Tesuque layers that rarely contain trough cross beds. Cross bedding in these redder layers indicate flow toward almost due west.

Cavazza (1985, 1986) defined compositionally distinct lithosomes on the basis of study in the central Espanola basin, southwest of the Truchas quadrangle. Neither lithosome, as defined by Cavazza, strictly describes Tesuque Formation strata in the Truchas quadrangle. The Dixon member resembles Cavazza's (1986) lithosome B, but most Dixon outcrops lack volcanic clasts that are essential to lithosome B. The high abundance, to overwhelming dominance, of quartzite in the quartzitic-arkosic map unit differs from lithosome A, which derives from erosion of the primarily granitic rocks of the Santa Fe Range.

Geomorphic Surfaces and Associated Deposits

High-level plateau surfaces between the Rio Quemado and Ojo Sarco define a flight of strath surfaces eroded by the ancestral Rio Quemado during the Pliocene and Pleistocene. Manley (1976) named the three highest surfaces after the adjacent modern drainages; these surfaces are, from north to south and highest to lowest, Oso surface, Entrañas surface, and Truchas surface. Manley recognized, but otherwise did not describe or name, a fourth, lower surface that, at one location near Truchas, is overlain by 1.61 Ma Guaje Pumice. We name this fourth surface the Ancha surface. Each of these surfaces is more complex in detail than implied by Manley's (1976) descriptions. They are really composite surfaces that, at least in part, are modified modern drainages that flow on or alongside them. These later modifications formed the lower Entrañas and lower Truchas surfaces located on the map.

Although the four composite surfaces formed by the ancestral Rio Quemado are obvious geomorphic features, it is not clear what, if any, deposits are associated with these former straths. Manley (1976) observed that the surfaces appear largely cut onto the Tesuque Formation with little if any recognizable younger strath gravel. We similarly found it impossible to consistently recognize gravel, separate from the Tesuque Formation, in the scattered available good exposures in ravines and roadcuts near the tops of these surfaces. Therefore, the geologic map depicts the surfaces, with the exception of local gravel

below the Ancha surface, the map does not show distribution of Plio-Pleistocene deposits associated with these surfaces. Scattered lag accumulations of quartzite boulders with long dimensions exceeding one meter are present on all of the surfaces and are coarser than observed clasts in the Tesuque Formation. These very coarse clasts were likely deposited in the Plio-Pleistocene during surface formation. Nonetheless, these clasts are not part of a readily mappable deposit, although it is possible that as much as 3 m of strata mapped as Tesuque beneath these surfaces are actually related to the younger surfaces.

Four terraces are mapped. The Santa Cruz terrace/surface of Manley (1976) is prominent along the Rio Quemado in the southwestern part of the quadrangle. A lower terrace underlies the community of Cordova, also along the Rio Quemado. Terrace gravel associated with the Rio de las Trampas is mapped in the northeastern part of the quadrangle, but no study of terraces in this drainage was undertaken. A prominent terrace above the Cañada de Ojo Sarco is the downslope equivalent of a long graded surface extending northward from the Oso surface.

Graded hillslope surfaces are common in the quadrangle and are probable relict Pleistocene(?) hillslopes. The Ojo Sarco surface is the most obvious of these surfaces and provides a natural ramp for the highway 76 grade south of Cañada de Ojo Sarco. The Los Alamos surface forms a similar landscape along ridges farther east. Less obvious, and not mapped, are surfaces graded to the Santa Cruz terrace near Cordova. Parts of highway 76 southwest of Truchas follow segments of these former hillslopes, as does the eastern connecting road between highway 76 and Cordova.

Structural Geology

The geologic map is notable in comparison to other quadrangles in the Española basin for a paucity of faults. There is no reason to suspect that the density of small-displacement faults should be less in this quadrangle than in quadrangles to the west and southwest. We ascribe the lack of mapped faults to the poor quality of exposure in the Truchas quadrangle. Users of the map should be aware that more faults almost certainly exist than are depicted on the map.

Most faults mapped by Kelley (1978) were, however, not collaborated in this study. Kelley (1978) mapped several NW-striking faults along drainages that dissect the high-level geomorphic surfaces north of Truchas. We suspect that these faults were interpreted primarily on the basis of drainage lineaments, and we see no compelling stratigraphic or geomorphic evidence for their existence. Also notable is the fault shown south of Truchas, which is demonstrated not to exist by almost continuous tracing of the depositional contact between the Tesuque Formation and Precambrian rocks.

Overall, dips in the Tesuque Formation are gently to the northwest, although northward dips as steep as 16 degrees are present in lowermost Tesuque strata south of Cordova. Dips in the southern part of the quadrangle define a north-sloping monocline (also apparent in the cross section) along the northern margin of the Santa Fe Range. This

gentle fold is consistent with the hypothesis that the Santa Fe Range has risen during the late Cenozoic by rupture along the Picuris-Pecos fault (Smith and Roy, 2001; Smith, in press).

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Table of clast count data collected during STATEMAP mapping of the Truchas quadrangle.

Data collected by G.A. Smith and M.N. Gaud in 2002 and 2003.

Count #	1	2	3	4	5	6	7	8
Map unit	Ttqa	Ttqa	Ttqa	Ttqa	Ttd	Ttqa	Ttqa	Ttqa
UTM (E/N)	425695/ 3988795	427475/ 3990075	427265/ 3990316	427265/ 3990316	429329/ 3997864	422294/ 3997961	421802/ 3997893	426854/ 3996406
Quartzite	52	80	74	74	37	89	69	65
Granite	39	21	25	25	1	6	30	33
Amphibolite	7	3	3	4		2	5	1
Schist		1	1				1	
Vein quartz						4		1
Limestone					22			
Sandstone	2		2	1	11			
Siltstone					21			
Total	100	105	105	104	100	101	105	100

Count #	9	10	11	12	13	14	15	16
Map unit	Ttqa	Ttqa	Ttqa(?) ¹	Ttqa	Ttqa	Ttqa	Ttqa	Ttqa(?) ¹
UTM (E/N)	428855/ 3993130	428296/ 3993020	421598/ 3989349	421598/ 3989348	421599/ 3989345	421522/ 3988270	422942/ 3992289	424578/ 399131
Quartzite	95	84	90	78	75	49	61	85
Granite	5	12	10	26	28	45	36	8
Amphibolite	1			3	2	4	5	
Schist				1		2		
Vein quartz	1	4				1		7
Limestone								
Sandstone								
Siltstone								
Total	102	100	100	108	105	101	102	100

Count #	17	18	19	20	21	22	23	24
Map unit	Ttqa(?) ²	Ttqa	Qtsc	Ttd	Ttqa	Ttqa	Ttqa	Ttqa
UTM (E/N)	425215/ 3992456	425098/ 3987450	424185/ 3986205	432244/ 3996768	429302/ 3992161	432227/ 3990690	428165/ 3987825	419829/ 3988120
Quartzite	92	45	72	43	80	90	60	48
Granite	6	53	25	1	17	3	39	52
Amphibolite		1	6				2	1
Schist							1	
Vein quartz	3			1	3	7	1	5
Limestone				11				
Sandstone		1		8				
Siltstone				24				
Total	101	100	103	101	100	100	103	106

Count #	25	26	27	28	29
Map unit	Ttqa	Ttqa	Ttqa	Ttqa	Ttqa
UTM (E/N)	419784/ 3988336	419742/ 3988457	419704/ 3988494	427294/ 3988475	423201/ 3984502
Quartzite	61	67	37	26	36
Granite	34	33	53	24	55
Amphibolite	1		5	2	3
Schist	2	1	5		2
Vein quartz	3				
Limestone					2
Sandstone					2
Siltstone					2
Total	101	101	100	42	102

¹Possible Truchas surface gravel

²Possible Entrañas surface gravel