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Pamphlet to accompany chemical analyses tables 1 and 2

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By Peter W. Lipman

As a follow-up to integrated mapping of the Oligocene Latir volcanic locus and the Questa caldera of the Southern Rocky Mountain volcanic field, north-central New Mexico (Lipman and Reed, 1989), all major-oxide and trace-element chemical analyses determined in laboratories of the U.S. Geological Survey for Cenozoic volcanic (table 1) and intrusive (table 2) rocks in this area have been compiled as two Excel files and organized by the stratigraphic sequence as presently understood. These tables include 550 published and unpublished analyses (233 volcanic, 317 intrusive) made between 1979 and 1985, undertaken concurrently with the field mapping and associated petrologic and geophysical studies by multiple researchers.

Table 1. Analyses of Tertiary volcanic rocks, Latir-Questa locus of Southern Rocky Mountain Volcanic Field. See Excel file at https://pubs.usgs.gov/imap/i-1907.

Table 2. Analyses of Tertiary intrusive igneous rocks, Latir-Questa locus of Southern Rocky Mountain Volcanic Field. See Excel file at https://pubs.usgs.gov/imap/i-1907.

The chemical analyses document the evolution of the Latir magmatic locus from initial intermediate-composition lavas and associated volcaniclastic rocks of high-K calc-alkaline composition from about 28 to 25.4 Ma to the culminating ignimbrite eruption of the peralkaline Amalia Tuff (~500 km^3) at 25.39±0.04 Ma (Zimmerer and McIntosh, 2012) and concurrent subsidence of the Questa caldera during early extension along the Rio Grande rift. Rugged erosional relief and displacements along rift-related faults provide exposures through the volcanic sequence down into an upper-crustal composite batholith. Broadly comagmatic with the volcanism are peralkaline and metaluminous granitoid plutons and numerous associated dikes, emplaced both within and south of the caldera area from 25 to 18.5 Ma. From about 18 to 4 Ma, diverse alkalic and tholeiitic basalt lavas accumulated within the Rio Grande rift adjacent to the Latir Mountains.

Analyses compiled include major oxides determined by wave-length dispersive x-ray fluorescence (WDXRF: Taggart and others, 1987) and some older analyses by single-solution chemical methods (Shapiro, 1975). Trace elements were variably determined by energy-dispersive x-ray fluorescence (Kevex: Siems, 2000), instrumental-neutron-activation (INAA: Budahn and Wandless, 2002), delayed-neutron, and isotope-dilution methods (Johnson and others, 1990). Analyses of major oxides are recalculated to reported totals, volatile free. Analyses of some glassy volcanic rocks (vitrophyres) are high in K_2O and low in Na_2O, owing to alkali exchange (Lipman, 1964). Some devitrified samples are extremely high in K_2O (as much as 7.1 wt. percent) and correspondingly low in Na_2O (to 0.6 wt percent), reflecting K-metasomatism (Ratté and Steven, 1967; Sweetkind and others, 1993). For trace-element determinations, detectability limits, precision, and elements reported have varied significantly during the years in which analyses have been made, and tables 1 and 2 display some inconsistencies in significant figures reported and in elements analyzed as a result. All the analyses are assigned unit labels that are consistent with those on the published geologic map (Lipman and Reed, 1989); some differ from those listed on sample submittal forms and in prior publications.

Most of the analyzed samples were collected and submitted for analysis by G.K. Czamanske, C.M. Johnson, and P.W. Lipman during studies of the Latir magmatic locus, the Questa caldera, and the Columbine-Hondo wilderness study areas between 1978 and 1984. Some additional analyzed samples were obtained by S. Ludington and John C. Reed, Jr. Sources of analyzed samples were located as reliably as possible and listed by geographic features and by longitude and latitude in the tables where known. Wherever possible, location coordinates have been compiled directly from 1:24,000-scale 7.5' field sheets. Locations for some samples are not known adequately to list in the tables.

The tabulated analytical data have provided a partial basis for multiple published interpretive reports, including Lipman (1983, 1988), Lipman and others (1986), Hagstrum and Lipman (1986), Cordell and others (1986), Czamanske and Dillet (1988), Johnson and Lipman (1988), Johnson and others (1989), Lipman and Reed (1989), and Johnson and others (1990). More recent interpretive studies of Tertiary igneous rocks, undertaken in the Latir-Questa region within the framework of the 1980s work, include Tappa and others (2011), Zimmerer and McIntosh (2012), and Rosera and others (2013). Sources of previously published chemical data are listed in table 3.

Table 3. Sources of previously published chemical data.

Reference	Unit or area covered	No. of analyses
Lipman (1983)	XRF major oxides and trace elements	20
Lipman (1987)	INAA analyses	15
Lipman (1988)	XRF major oxides and trace elements	18
Johnson and Lipman (1988)	XRF major oxides and trace elements	32
Johnson and others (1989)	XRF major oxides and trace elements	57
Thompson and others (1986)	XRF major oxides and trace elements	15

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