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NURE DATA FOR GROUNDWATER AND STREAM SEDIMENTS, BLM ROSWELL RESOURCE MANAGEMENT AREA, EAST-CENTRAL NEW MEXICO

by

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NURE DATA FOR GROUNDWATER AND STREAM SEDIMENTS, BLM ROSWELL RESOURCE MANAGEMENT AREA, EAST-CENTRAL NEW MEXICO

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Introduction

The geochemical data given here were used to evaluate the surface and subsurface mineral endowment of the Bureau of Land Management (BLM) Roswell Resource Management Area, New Mexico. These data complement a report that integrates geological data with a mineral and energy resource asessment of the area (Bartsch-Winkler, 1992).

The Roswell Resource Management Area is located in east-central New Mexico between about 33°--36°N latitudes and 103°--106°30"W longitudes (fig. 1). The area of 14,014,720 acres (about 21,890 sq mi) includes all of Guadalupe, Quay, DeBaca, Curry, Roosevelt, Lincoln, and most of Chaves counties. Of this total acreage within the study area boundaries, about 1.5 million surface acres (2,320 sq mi) and 3.9 million subsurface (mineral rights) acres (about 6,075 sq mi) are managed by BLM.

Several sources of geochemical data are available for the Roswell Resource Management Area, but only two are large enough to be used in a mineral-resource assessment. These two included the data base from the National Uranium Resource Evaluation program (NURE) and another large but more areally limited data base that consists of 819 stream-sediment samples from National Forest lands in and near the White Mountain Wilderness Area in the southern end of Lincoln County (fig. 1). The White Mountain Wilderness Area has already been assessed for its mineral-resource potential (Segerstrom and others, 1979; Segerstrom and Stotelmeyer, 1984).

The NURE Database

The NURE database represents broad coverage with sample sites fairly evenly distributed throughout the resource area. The Hydrogeochemical and Stream Sediment Reconnaissance Program (HSSR)--one of five parts of the NURE effort--consisted of sampling surface water, groundwater, and stream, pond, and lake sediments. Los Alamos National Laboratory (LANL) was responsible for conducting the HSSR program in New Mexico, as well as several other Rocky Mountain states and Alaska, and for analyzing all the samples for uranium. Field-sampling techniques are detailed in Sharp and Aamodt (1978).

Supplemental analyses--that is, analysis of samples for elements other than uranium--were conducted for most of the samples from the Roswell Resource Management Area by the Oak Ridge National Laboratory (ORNL) in Tennessee (fig. 2). The participation of two different laboratories created difficulties in the data presentation, as discussed in Erdman and others, 1992 and described below.

U.S. Geological Survey 2-degree quadrangles were used as base maps for the NURE hydrogeochemical and stream-sediment surveys. The Roswell Resource Management Area

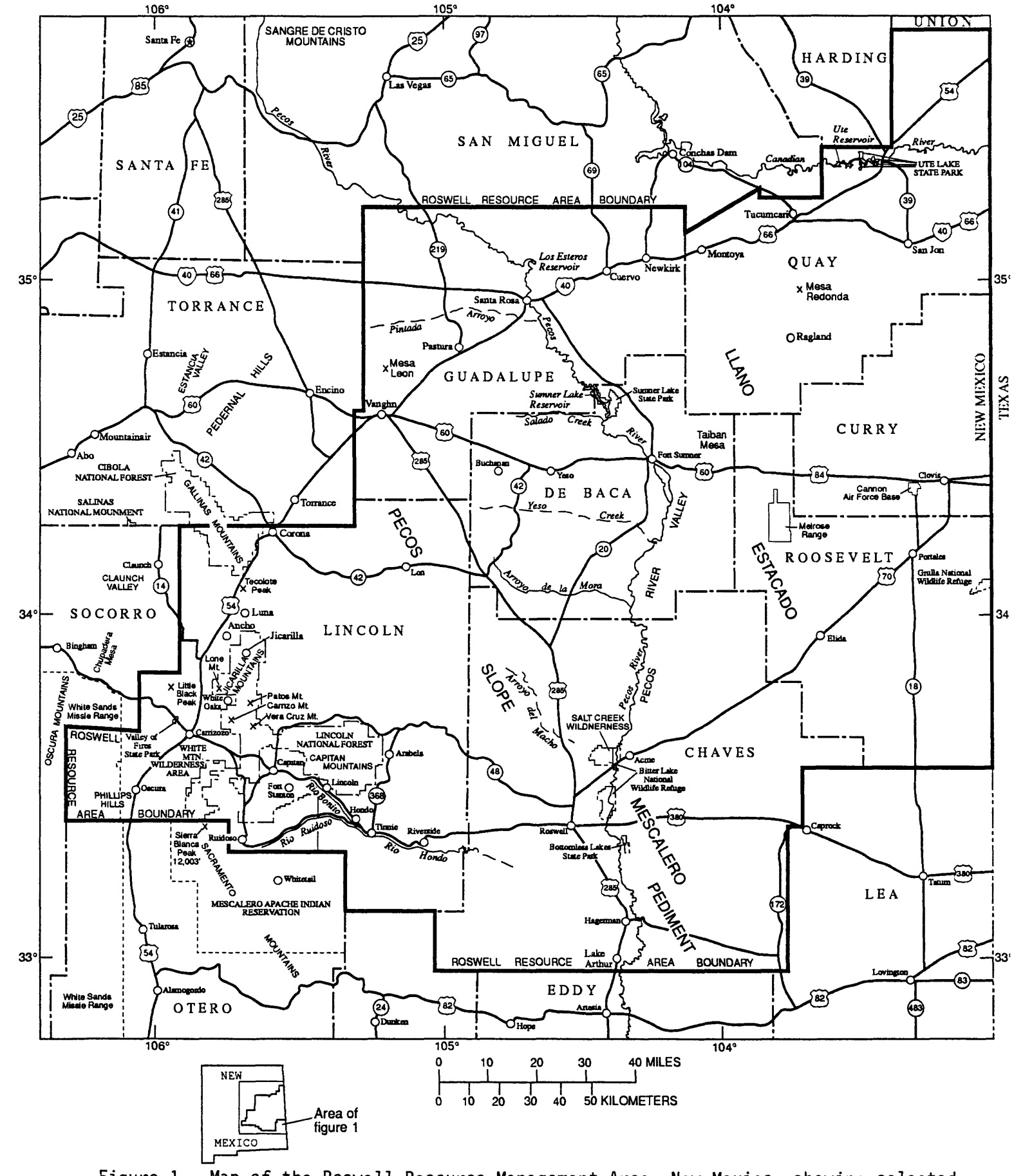

Figure 1.--Map of the Roswell Resource Management Area, New Mexico, showing selected locations and physiographic features (from Bartsch-Winkler, 1992).

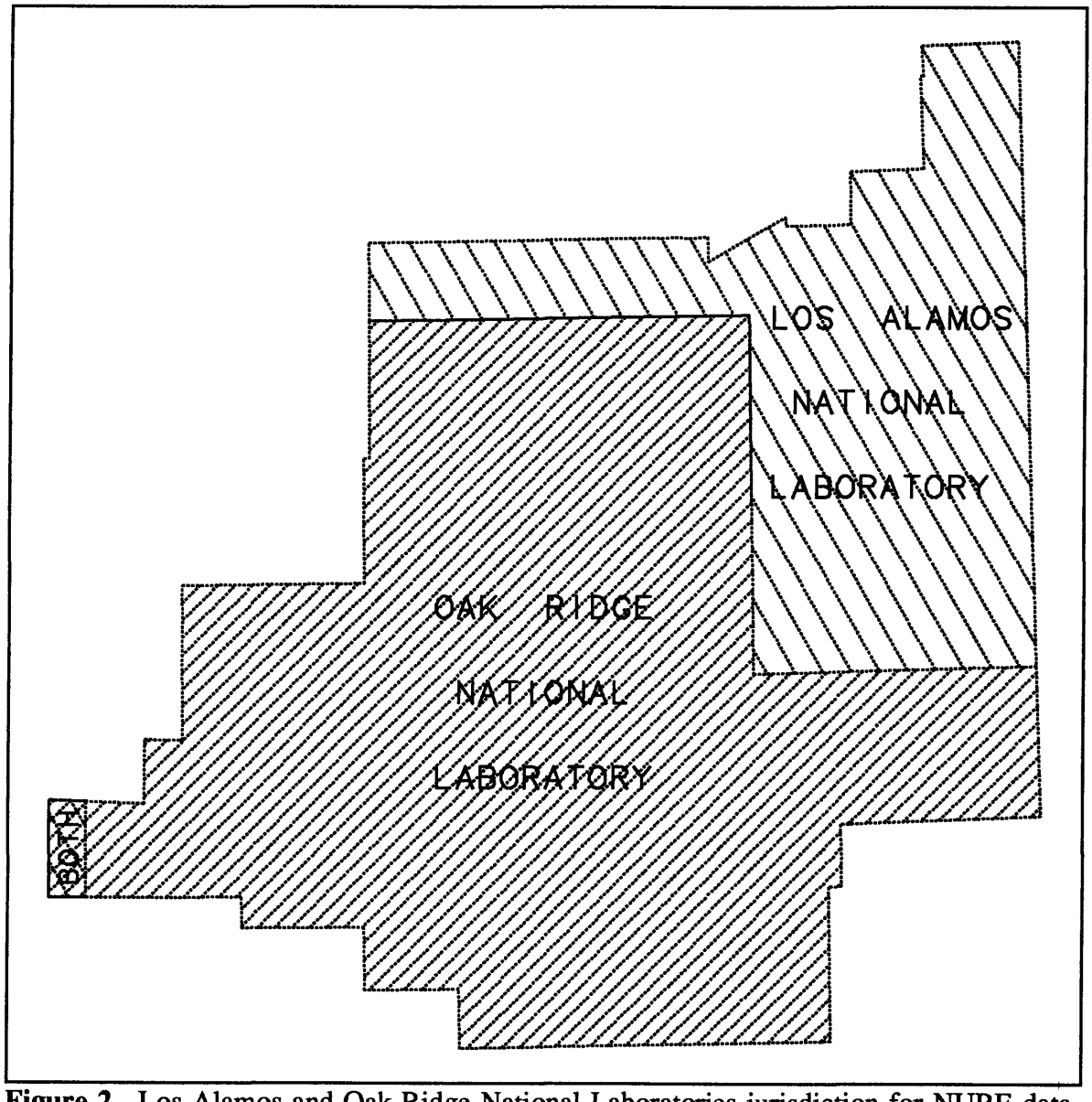

Figure 2.--Los Alamos and Oak Ridge National Laboratories jurisdiction for NURE data in the Roswell Resource Area

encompasses parts of nine such quadrangles, with the Roswell and Fort Sumner quadrangles most represented. The NURE data are available for each of these quadrangles in 12 separate reports (Broxton, 1978; LaDelfe, 1981; Los Alamos National Laboratory, 1980-1982; Oak Ridge National Laboratory, 1981a-f; Warren and Nunes, 1978). All the NURE data bases for the quadrangles in New Mexico have recently been made available by the New Mexico Bureau of Mines and Mineral Resources (McLemore and Chamberlin, 1986).

Sample Media

The initial data retrieval from the NURE tapes (archived by the USGS) produced 5,872 samples, about half of which are water samples and half sediment samples. The 3,059 water samples consist of five types in two general categories: 165 surface-water samples (stream, natural pond, and artificial pond), and 2,894 groundwater samples. The latter number includes 84 samples from springs. All water samples were filtered through a 0.45-micron membrane filter and acidified to the same pH. Because the number of surface-water samples is small and the areal coverage is not uniform, we did not use the surface-water data. Extensive sinkhole (karst) topography in much of the study area limits clearly defined drainage systems.

The 2,813 sediment samples consist of eight types: dry and wet stream sediments, dry and wet natural-pond sediments, dry and wet artificial-pond sediments, and dry and wet spring sediments. Most of these samples--1,938--are dry stream sediments. All sediment samples were treated in a similar manner, dried at the same temperature and sieved to minus 100-mesh (0.15 mm), so we combined all eight types into the same data base.

Finally the numbers of samples in the groundwater and sediment data bases actually used (given below) were reduced from the above totals because of missing data for some elements and--in the case of zinc data on sediments analyzed by LANL--because of variable lower limits of determination. There were no groundwater samples collected in a large area in the western-central part of the study area including parts of the Roswell and Fort Sumner quadrangles. The reason is unknown.

Sample Analysis

All uranium analyses for both water and sediment were conducted at LANL. Water samples were initially analyzed for uranium by fluorometry (Hues and others, 1977). Those samples that contained more than 40 parts per billion (ppb)--the upper limit of determination without recalibration--were reanalyzed either by (i) a modification of the basic fluorometric method that expands the range of determination; in particular the lower limit of determination in natural waters changes from 0.50 to 0.02 ppb, (ii) delayed-neutron counting (DNC), or (iii) mass spectrometry-isotope dilution. All sediment samples were analyzed for uranium by DNC.

The greatest difficulty in handling the NURE sediment data derived from the inconsistent analytical methods being used for supplemental elements by the two laboratories. Los Alamos National Laboratory used neutron activation analysis, energy dispersive x-ray fluorescence (Hansel and Martell, 1977), and arc-source emission spectrography--all *total* analysis techniques. The laboratory at Oak Ridge, however, used plasma source emission spectrometry as part of a *partial-extraction* method described by Cagle (1977) and Arendt and others (1979). For this reason, the supplemental data bases from the two laboratories could not be combined but had to be handled and interpreted separately in the interpretative report (Erdman and others, 1992).

Useable data sets consisted of uranium in 2,507 groundwater samples; uranium in 2,391 sediment samples; 2,004 sediment samples analyzed by ORNL for the selected supplemental elements, barium (Ba), cerium (Ce), copper (Cu), lanthanum (La), lithium (Li), molybdenum (Mo), potassium (K), silver (Ag), thorium (Th), vanadium (V), and zinc (Zn); and 387 sediment samples analyzed by LANL for the selected supplemental elements, Ba, Ce, Cu, K, La, Li, Th, V, and Zn. Los Alamos National Laboratory analyzed the sediment samples for Li by emission

spectrometry, for Ag and Cu by x-ray fluorescence, and for the remaining elements listed by neutron activation. The data set for zinc in sediments analyzed by LANL was adjusted to 345 samples because of the excessive variable lower limits of determination encountered (USGS unpublished computer program GXFIXX, A.T. Miesch, 1984). The supplemental data for the groundwater samples were not used. The pH of 2,854 groundwater samples was not included as part of the interpretation by Erdman and others (1992), but the data are included on the distribution disk (part B of this report).

Data Format

All information that served as the basis for the mineral resource appraisal of the Roswell Resource Management Area has been reported to the sponsoring agency, the BLM, both in hard copy (Bartsch-Winkler, 1992) and digital data on a 1.2 Mb, 5-1/4 inch floppy disk (part B of this report). Each data file is in two formats: (1) a binary file in the *export* format (**.E00**) of the geographic information system (GIS) program, ARC/INFO[2] and (2) a file in an ASCII format (**.ASC**) for general use. The export format can be imported directly into an ARC/INFO program. The data files contain NURE laboratory sample numbers, latitude, longitude, and analytical data for a number of elements as shown below. The several data files are compressed into self-extracting archives which contain the following files, respectively:

GRDWATR.EXE: (groundwater, self-extracting archive)
- GWPH.E00 (pH)
- GWPH.ASC (pH)
- GW-U.E00 (U)
- GW-U.ASC (U)

LOSALMOS.EXE: (stream sediments, self-extracting archive)
- LALRE.E00 (rare-earth elements: Ce,La)
- LALRE.ASC (rare-earth elements: Ce, La)
- LASED1.E00 (supplementary elements I: Ag, As, Ba, Bi, Cr, Cu, Fe, K)
- LASED1.ASC (supplementary elements I: Ag, As, Ba, Bi, Cr, Cu, Fe, K)
- LASED2.E00 (supplementary elements II: Li, Mn, Ni, Pb, Th, Ti, V)
- LASED2.ASC (supplementary elements II: Li, Mn, Ni, Pb, Th, Ti, V)

OAKRIDG.EXE: (stream sediments, self-extracting archive)
- ORLRE.E00 (rare-earth elements: Ce, La)
- ORLRE.ASC (rare-earth elements: Ce, La)
- ORSED1.E00 (supplementary elements I: Ag, Ba, Cr, Cu, Fe, K, Li)
- ORSED1.ASC (supplementary elements I: Ag, Ba, Cr, Cu, Fe, K, Li)
- ORSDE2.E00 (supplementary elements II: Mn, Mo, Ni, Pb, Th, Ti, V)
- ORSED2.ASC (supplementary elements II: Mn, Mo, Ni, Pb, Th, Ti, V)
- SEDS-U.E00 (U)

[2]Proprietary program of ESRI, Inc., Redlands, CA.

SEDS-U.ASC (U)

Each of the self-extracting, compressed archive files must first be uncompressed and extracted on a PC-type computer under a DOS operating system. Simply type on the command line the name of the archive file, for example,

GRDWATR <enter> comment: appears as GRDWATR.EXE on the disk; creates export files, GWU.E00 and GWPH.E00 and ASCII files, GWPH.ASC and GWU.ASC.

Transfer the .E00 files to an ARC/INFO host computer by whatever available means and IMPORT the files into ARC/INFO. The .ASC files may be read on most general purpose computers that can accommodate a floppy disk.

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