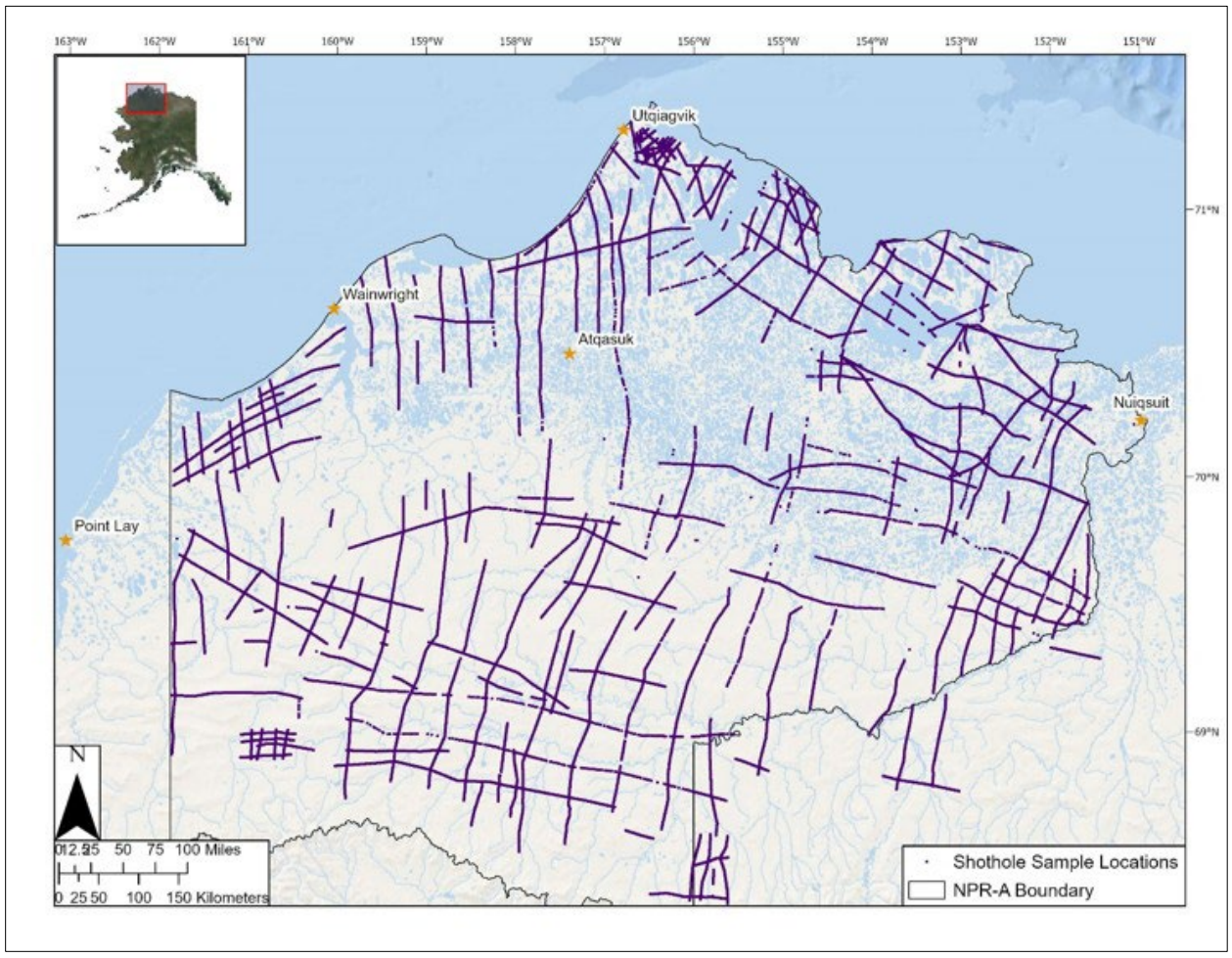
Catalog of drill log cards and sample images from USGS seismic shothole sites in the National Petroleum Reserve – Alaska (1974–1981)

Nick E. Crawford, Simone Montayne, Tyler B. Stokes, Trent D. Hubbard

Raw Data File 2025-18 v. 2



Shotline and shothole sample location map

Raw Data Files provide elevation data, field observations, or analytical data. They are reviewed for clarity and consistency but do not undergo technical peer review.

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Catalog of drill log cards and sample images from USGS seismic shothole sites in the National Petroleum Reserve – Alaska (1974–1981)

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ABSTRACT

This publication presents transcribed drill card data and photographs of geologic samples from seismic shotholes in the National Petroleum Reserve – Alaska (NPR–A). Between 1974 and 1982, more than 12,000 line miles of seismic data were acquired in the reserve (U.S. Geological Survey [USGS], 2019), and USGS geospatial data show the approximate locations of 99,850 holes, up to 175 feet deep, drilled for emplaced seismic charges (USGS, 2019). At each site, drillers logged the hole and collected "grab" samples of material brought to the surface. Drill cards and samples from roughly 35,650 of these sites, drilled between 1974 and 1981, are archived at the Alaska Geologic Materials Center (GMC) in Anchorage. Using these materials, the Alaska Division of Geological & Geophysical Surveys (DGGS) photographed the cards and samples and tabulated transcriptions of drillers' observation notes from approximately 26,000 sites, covering a data extent of almost 100,000 km². This subset is the portion of the archive closest to North Slope communities and potential infrastructure development. The dataset is foundational to a broader initiative to modernize and enhance the NPR–A seismic shothole sample dataset, and it supports local and regional efforts to identify economically viable sand and gravel deposits. The data are released as a Raw Data File and are available for download from the DGGS website https://doi.org/10.14509/32137. The samples are housed by the GMC and are available for viewing upon request: https://maps.dggs.alaska.gov/gmc/inventory/search.

DATA PRODUCTS

- Report and database documentation
- Geodatabase containing seismic shotline and shothole locations (USGS, 2019), links to shothole sample images, and drill card shothole descriptions; For an overview of how the geodatabase and associated records are organized, see figure A-1 (app. A).

BACKGROUND

This work was part of a multi-year sand and gravel resource assessment of Alaska's North Slope, conducted under the Arctic Strategic Transportation and Resources project (ASTAR). ASTAR was a collaborative initiative led by the Alaska Department of Natural Resources in partnership with the North Slope Borough and the Alaska Department of Transportation and Public Facilities (ADOT&PF). Its goal was to identify, evaluate, and advance opportunities to improve quality of life and economic development in North Slope communities through responsible infrastructure planning. The team worked with communities and regional stakeholders to identify priority projects and areas that would benefit most from improved community and cultural connectivity, regional coordination, lower cost of living, improved safety, and sustainable infrastructure development. Data are often limited in remote regions such

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as the NPR–A and acquiring new information can be costly. By making historical data easier to find and use, the project helps stakeholders coordinate data collection, avoid duplication, and make informed land-use planning and management decisions.

METHODS

Data Collection

Phase 1

The geologic material samples and drill cards from individual shothole drill locations collected during NPR–A seismic investigations were stored in labeled sample bags in boxes at the GMC. Staff located specific boxes using the GMC's online inventory database. The database included the shotline number, shothole number, and the box identification barcode. Within each box, sample bags were labeled with the shothole and shotline numbers. Staff obtained the geographic location of each sample and shotline from the NPR–A Legacy Seismic Data Archive (USGS, 2019). They then reviewed each box label, photographed every sample with its drill card, and compiled cataloging information for each shothole sample (fig. 1).

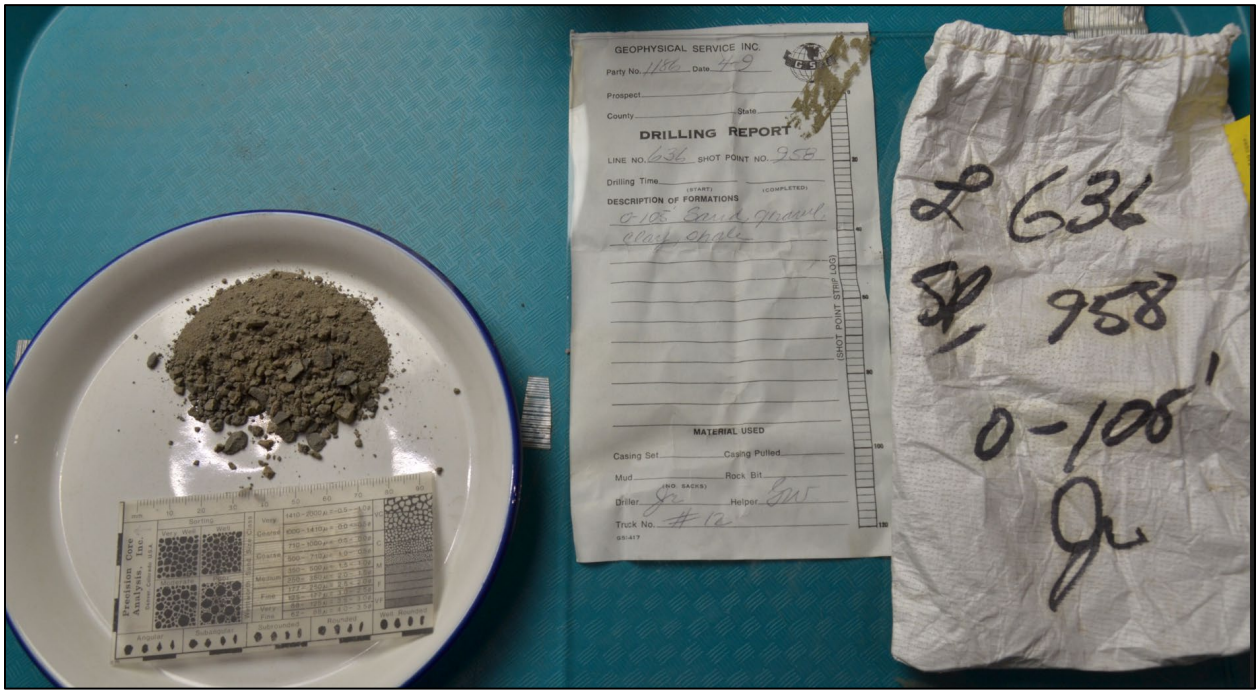


Figure 1. Sample staging example

Drill cards typically record the sample collection date, the drill team, and details about the drill hole contents. Catalogers verified that each drill card (when present) matched the sample bag label and could be linked to the sample identifiers in the USGS archive record. They placed the drill card and sample bag on a flat surface, disaggregated the sample, arranged it on a glass plate with the bag beside it, and photographed the setup. When applicable, they spread the sample material across plates to capture key sediments, such as pebbles or coal fragments, in the

images. After photographing, they returned the samples to their original bags and boxes at the GMC.

Phase 2

Roughly half of the selected samples were accompanied by shothole drill cards containing information on subsurface depth and character (fig. 2). Many cards also recorded the observer's name, drill bit types, drilling complications, blasting, and shot point locations (for example, offset distances). Staff reviewed each drill card photograph and transcribed key data useful for geologic material resource exploration, particularly interval depths and geologic material characteristics.

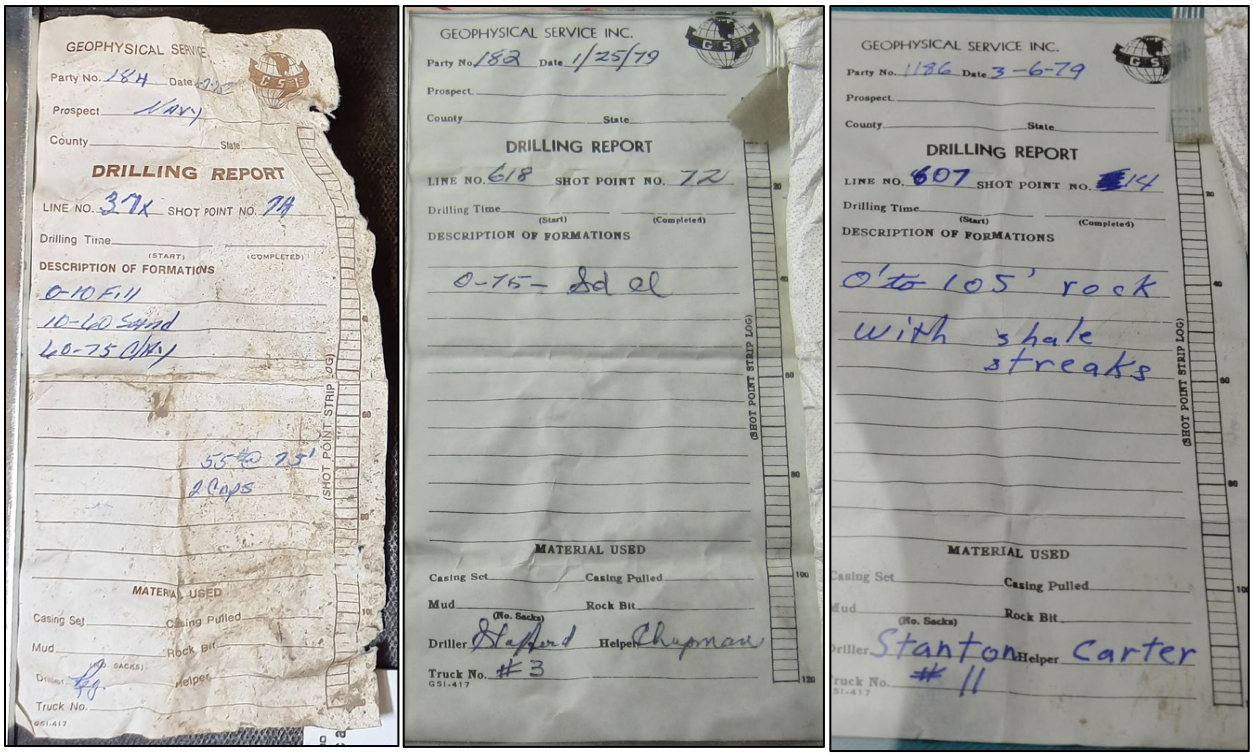


Figure 2. Drill card and notation examples

Shotholes were drilled by several companies over the course of the NPR–A exploration program, and the legibility, completeness, and quality of the drill card information vary considerably. The compilers did not alter or interpret the original text, except to correct obvious spelling errors and standardize all text to lowercase. Punctuation was generally preserved as recorded. Interval observation descriptions often spanned multiple lines, and drillers sometimes used line breaks instead of punctuation to list materials. Staff combined such multiline entries into single lines separated by spaces, with no added punctuation. Where specific interval depths were not recorded, but a total hole depth was provided, the interval top was assumed to be zero and the bottom to be the total depth. Cards that lacked depth information entirely were flagged as "interval missing."

Table 1 lists examples of common shorthand in the dataset, along with inferred synonyms. To support data filtering and geologic material distribution modeling, staff explored mapping shorthand variants to a controlled vocabulary but found the notes too ambiguous and incomplete for reliable classification.

Table 1. Examples of common shorthand used throughout the dataset, along with inferred synonyms.

Term	Inferred Synonyms
clay	cl
sand	sd, sandy?, s, sd.
gravel	gr, gr., g
shale	sh, s., sh.
sandstone	ss, s. stone, s stone, sandrock, s.s.
bedrock	rk, rk., r
permafrost	p. f., frozen, f., icy
layers	streaks, strks., strks, stringers, strips
soft	s
hard	h
and	with, +

LIMITATIONS

Collecting detailed subsurface geologic materials data was outside the scope of the NPR–A seismic program, and much of the information on the drill cards is rudimentary. Using this dataset to derive regional-scale quantitative resource estimates would be problematic. The accuracy and consistency of lithologic descriptions vary widely among shotholes. Some drill cards provide detailed accounts of subsurface materials, while others offer minimal information. In certain cases, review of sequential cards suggests that drill cards were pre-filled or photocopied before drilling, so their descriptions may not reflect actual subsurface conditions. Many drill cards were also missing, damaged, or difficult to read. Staff also noted problems with geologic material identification. Comparison of driller notes with hand samples indicates that gravel is likely significantly overrepresented, because drillers classified coarse-grained alluvial and colluvial materials, as well as crushed bedrock, using a range of overlapping terms, such as gravel, rock, bedrock, hard shale, and limestone, and numerous abbreviations of these terms. Conversely, comparison with hand samples shows that shallow coal, although not a focus of this analysis, was rarely noted on the drill cards and appears to be widespread in parts of the study area. This database facilitates navigation of the shothole records. However, users conducting interpretive or analytical work should review the drill card and sample images directly and not rely solely on the transcribed text.

Horizontal positional accuracy has not been quantified. Shothole locations were established during seismic surveys from 1974 to 1982, before GPS was available, and were located using the survey and navigation methods of that era. This dataset uses the locations obtained from the USGS dataset and did not independently verify them. Locations may be offset from the true drill sites by 100s of meters or more, and errors may vary by shotline, survey contractor, and year. Users who need precise locations should not rely on these coordinates alone.

DISCUSSION

The NPR–A seismic shothole dataset is a unique systematic, regional-scale investigation of the distribution and character of shallow subsurface geologic materials throughout the North Slope region. Although the sample photographs and driller notes do not support spatial and volumetric modeling and must be used with caution, they provide valuable information about shallow subsurface characteristics and geologically significant horizons that archived bulk samples, surficial geologic mapping, and lidar and satellite remote sensing does not capture. Taken together with the sample images, these driller notes provide critical subsurface information that would be prohibitively costly to recollect and replicate. In sum, the notes and shothole sample images provide subsurface detail that serves as a launch point for further investigation and, ultimately, scientifically informed decision-making for responsible energy and infrastructure development in Alaska's remote, infrastructure-limited environments.

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REFERENCES

U.S. Geological Survey, 2019, National Petroleum Reserve-Alaska (NPR–A) legacy seismic data archive: U.S. Geological Survey database, accessed 2020, at https://www.usgs.gov/tools/national-petroleum-reserve-alaska-npra-legacy-seismic-data-archive

APPENDIX A

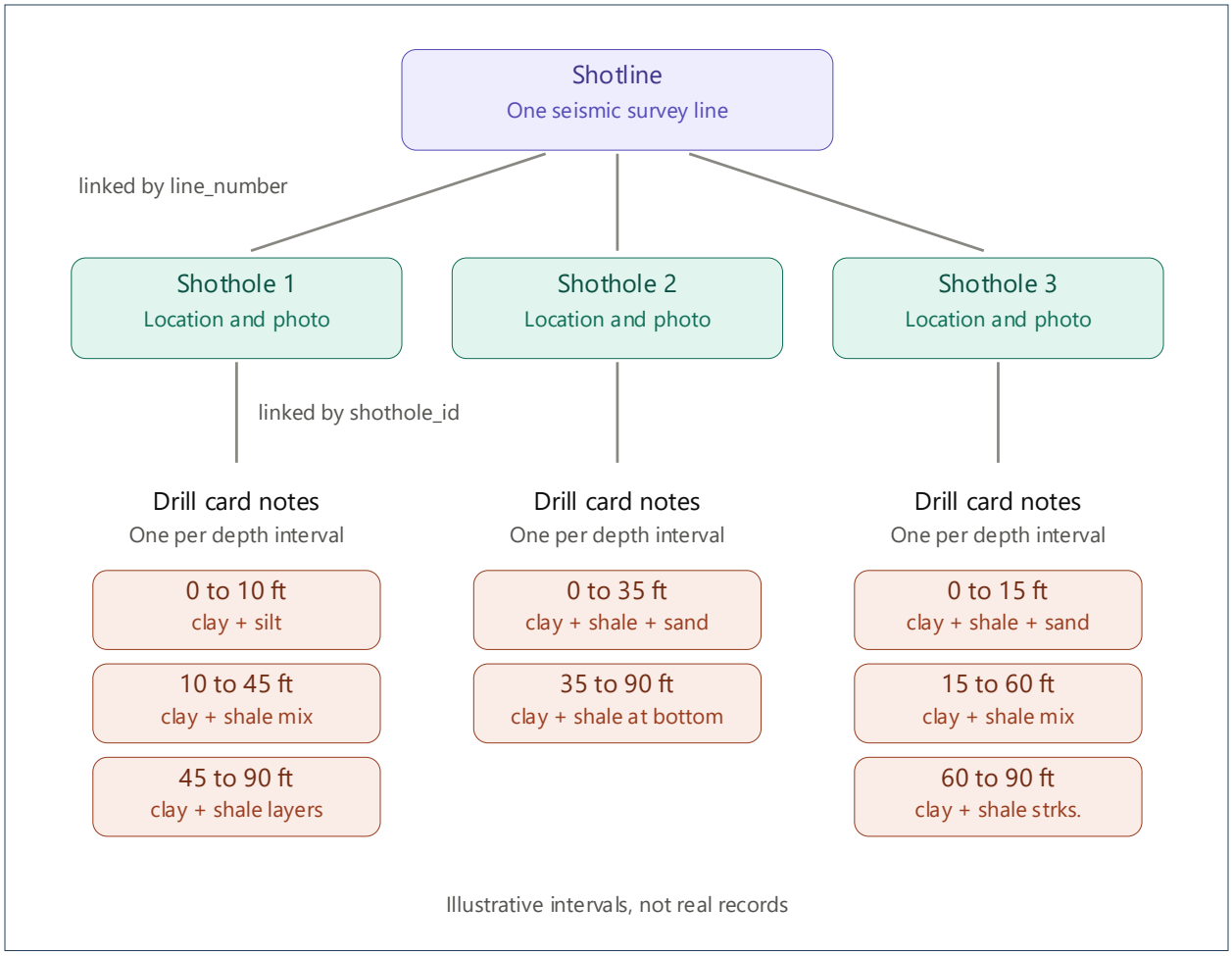


Figure A-1. Overview of the geodatabase showing how seismic shotline and shothole location records (USGS, 2019) are linked to shothole sample images and drill card descriptions.