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U.S. Geological Survey–PetroBangla Cooperative Assessment of Undiscovered Natural Gas Resources of Bangladesh

Petroleum Systems and Related Geologic Studies in Region 8, South Asia

U.S. Geological Survey Bulletin 2208-A

U.S. Department of the Interior
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By USGS-Bangladesh Gas Assessment Team

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Edited by Craig J. Wandrey

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The Bangladesh gas resource assessment was conducted under the purview of the Participating Agency Service Agreement (PASA) signed between USAID and the U.S. Department of Energy (DOE)—PASA No. 388-P-00-99-00026. The 2-year agreement expires on August 19, 2001.

The PASA provides for assistance to the Natural Gas Sector pursuant to which the resource assessment was jointly carried out. PASA also envisages transfer of new technology, modeling practices, and geoscience theory from existing and established programs in the United States to the Government of Bangladesh, Petrobangla, and Bangladesh academia.

In preparation for the cooperative assessment effort, Bangladesh geoscientists received training and familiarization from the U.S. Geological Survey in world resource assessment methodology.

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Gale A. Norton, Secretary

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Charles G. Groat, Director

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Part I—Overview

Introduction

A natural gas assessment of the country of Bangladesh was conducted after a 21-month study performed by the U.S. Geological Survey (USGS) and funded by the U.S. Agency for International Development. This project culminated in an assessment meeting that was held in Denver, Colo., from January 16 to January 26, 2001. The assessment team consisted of six geologists from the USGS's World Energy Resource Assessment Team and seven geologists, geophysicists, geochemists, and a petroleum engineer from Petrobangla. A regional assessment geologist from the USGS assigned to Bangladesh presented the geological and geophysical data needed for the formal assessment. International oil companies were invited to present geological background and assessment information and included Unocal Corporation, Shell Bangladesh, and Cairn Energy PLC. The goal was to assess the technically recoverable undiscovered gas resources of Bangladesh that might be found in a 30-year period (2000–2030).

The methodology used was that of the U.S. Geological Survey World Energy Assessment Team (2000) and is described in detail in that publication. This methodology has been used in assessments throughout the world. It has been reviewed extensively and formally endorsed by the American Association of Petroleum Geologists.

The USGS periodically conducts geologically based assessments of hydrocarbon resources of the United States and of the world. As part of the process, regional geologists present descriptions of the petroleum geology and known hydrocarbon resources of the region to be assessed to the assessment team. This information is used to identify and describe total petroleum systems (TPS) within the assessed region. As far as possible, total petroleum systems encompass the natural process that begins with the generation of hydrocarbons from kerogen-rich source rocks, is followed by the migration of hydrocarbons from their source area, and ends with their entrapment within reservoir rocks beneath relatively impervious seals. The area (or country) in which that total petroleum system is active is then divided into assessment units (AU). Assessment units are areas of specific geological terrain and hydrocarbon development within a given total petroleum system. Available historical oil and gas production data from existing wells and fields and information on discovered prospects and leads are then allocated to each AU. The AU is characterized as to type of hydrocarbon—in this case gas rather than oil—the minimum field size to be assessed (42 billion cubic feet of gas (BCFG) for Bangladesh), the number of discovered fields exceeding the minimum size, and the median size of discovered gas fields. Geologic elements may be risked only when no fields of the minimum field size have been discovered within an AU. In such a hypothetical AU, assessment unit geologic risk probabilities are determined for adequate petroleum charge, reservoirs, traps, and seals—the timing of geologic events must be such that traps form in time to intercept migrating gases. These probabilities are multiplied together to determine the geological risk for an accumulation of one deposit equal to or greater than the minimum field size. If there is no risk that one field of minimum size will be discovered, the risk is 1. Accessibility is also risked to account for the possibility of adequate locations to allow for exploration for a field equal to or greater than the minimum field size to be found within a 30-year time frame.

Utilizing these data, their understanding of the geology and hydrocarbon potential of each AU, and their combined knowledge of world petroleum resources and geology of hydrocarbon accumulations worldwide, the assessment team conducts an iterative analysis of each AU until they reach a consensus on the ranges of the numbers and sizes of undiscovered fields (minimum, median, maximum) in that unit. These data are input onto a seventh approximation data form (Schmoker and Klett, 1999) and then into a computer program (EMC2, Charpentier and others, 2000) that generates probabilistic forecasts of the undiscovered resources contained within the AU, such as the amount of gas in gas fields, or oil in oil fields, and their coproducts.

Ratios of liquids to gas—and ancillary data such as the composition of the gas or oil, drilling depths, and depths of water (if offshore)—are entered onto the form, and allocations

are made as to the location of the resource; in this case, onshore vs. offshore. In this study, these data are used to calculate undiscovered resources of natural gas liquids and to allocate those resources to the onshore and offshore portions of Bangladesh. Data used in this study reflect known field size data provided by Petrobangla, and these fields were not grown in this analysis. Only undiscovered technically recoverable resources were estimated in this study.

In order to organize, catalog, spatially display, and query the large variety and quantities of data collected for this assessment a geographic information system (GIS) was developed. The GIS contained cultural, stratigraphic, structural, magnetic, gravity, reservoir, well, field, production, and seismic data. The ability to interactively query, spatially display, and compare relevant information during the assessment greatly enhanced the assessment process. The GIS now provides a documented digital database on which the Government of Bangladesh and Petrobangla can build for future assessments.

Acknowledgments

Additional data was provided by independent oil companies (IOC's) operating in Bangladesh. These IOC's were Unocal Corporation, Shell Bangladesh, Carin PLC, and Haliburton.

Assessment of Gas Resources of Bangladesh

General Geology

Previously, the USGS had conducted an assessment of the Ganges-Brahmaputra Province, including parts of India and Myanmar and almost all of Bangladesh, as documented in the World Petroleum Assessment 2000. (U.S. Geological Survey World Energy Assessment Team, 2000). The current assessment reflects new information for the time period 1995 to 2000 and utilizes considerable proprietary data for this new Petrobangla/USGS country-level assessment.

The petroleum geology of Bangladesh may be traced back in time to the latest Paleozoic (350 million years ago) when the ancient continent of Pangea broke apart and fragments of the Earth's crust began to migrate northward toward an ultimate collision with the southern portion of Asia. One of these lithospheric fragments, the Indian subcontinent, continued to drift throughout almost all of the Mesozoic and into the early Cenozoic before collision with southern Asia closed the ancient ocean on the north of the Indian subcontinent and drove up the Himalaya Mountain chain. At the same time, collision, subduction, and compressional forces formed the mountainous regions in Myanmar to the east and produced the geoanticlinorium of the Arakan Yoma in adjacent Myanmar and eastern India. These recently uplifted highlands to the north and east, as well as the ancient land mass of India on the west, were subsequently eroded and shed sediment into the deep basin to the east, south, and west into the area currently underlying the great Ganges-Brahmaputra delta. The sediments of the Ganges-Brahmaputra delta underlie almost all of Bangladesh, parts of eastern India, and West Bengal, India. Total sedimentary thickness in Bangladesh is unknown but probably exceeds 20,000 m in the area of the Surma Basin and in the southern part of the Ganges-Brahmaputra delta (fig. 1). This thick pile of sediments overlies the deeply buried crust of the ancient Indian subcontinent on the west and now deeply buried oceanic crust on the east. On the east, where the oceanic crust beneath the delta is being subducted into the Earth beneath the Burma plate, the overlying sediments are being scraped off into a series of elongate, gentle to complexly faulted folds.

The Tertiary Composite Total Petroleum System

Although the petroleum geology and hydrocarbon potential of the delta is not well understood and exploration for hydrocarbons is in its early stage in this region, the elements of one or more potential total petroleum systems have been identified within the deltaic sediments. Possible source rocks, strata with greater than 0.5 percent total organic carbon, have been identified in western Bangladesh and West Bengal, India, in the area occupied by the Surma Basin, and in the greater part of the subaerial delta and offshore regions in southern Bangladesh (Shamsuddin and Abdullah, 1977; Hajra and others, 1977, Bangladesh Oil Gas and Mineral Corporation, 1986). Sandstone reservoir rocks with high porosity (as much as 30 percent) are overlain by, and in places surrounded by, relatively impervious shale beds that seal gaseous and liquid hydrocarbons within traps and prevent them from escaping to the surface. Buried deeply in the subsurface, source rocks have been generating hydrocarbons almost since the formation of the delta.

The eastern fold belt, known as the Chittagong-Tripura fold belt, contains large anticlinal folds that serve as traps for hydrocarbons within the Surma Basin and throughout much of eastern Bangladesh. These geologic structures have been forming for the last 5 million years, more or less, and thus far have proved to contain the largest gas fields in Bangladesh. Other traps abound and include a wide variety of stratigraphic traps and combinations of structural and stratigraphic traps. Extensional faulting and roll-over anticlines are a dominant structural trap in many of the world's deltas and, given the high sedimentation rates of the Ganges-Brahmaputra delta, are certain to be an important type of trap in Bangladesh. Migration pathways from source rocks to reservoirs apparently occur along deep-seated steeply dipping to vertical faults, and laterally along porous zones within subhorizontal to gently dipping strata.

In summary, although total petroleum systems are clearly working in the Ganges-Brahmaputra delta to produce hydrocarbons and transport them from their source rocks into sealed reservoirs, there is not yet enough data to correlate hydrocar-

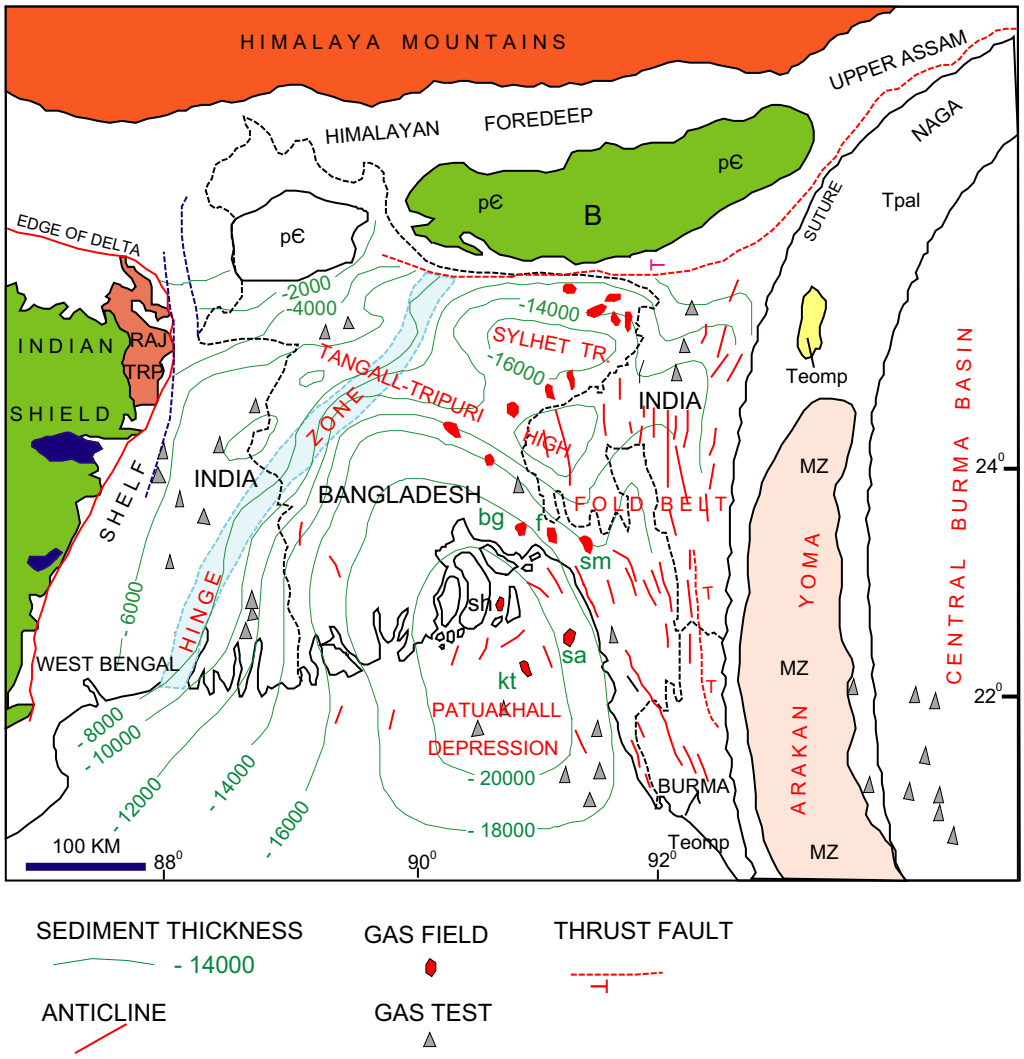

Figure 1. Generalized geologic map of Bangladesh and adjacent areas. Surma Basin is same as Sylhet Trough. Adapted from Shamsuddin and Abdullah (1997).

bons in reservoirs with their specific source rocks, although a deep Oligocene formation appears to be the most likely source rock. The total petroleum system within this great Tertiary delta is treated as a single composite total petroleum system (TPS), the Bang01 Tertiary Composite total petroleum system. The nomenclature, coding system and supporting analytical database follows procedures formally described in the USGS World Petroleum 2000 (U.S. Geological Survey World Energy Assessment Team, 2000).

Assessment Units

The USGS-Bangladesh Gas Assessment Team divided the country into six assessment units, based to a large degree their geological structural attributes. These are: Bang0101 Surma Basin assessment unit; Bang0102 Easternmost Extremely Folded assessment unit; Bang0103 High-Amplitude Faulted Anticlines assessment unit; Bang0104 Moderately Folded Anticlines assessment unit; Bang0105 Western Slope assessment unit; and Bang0106 Western Platform assessment unit (fig. 2). The first pages of Addendum 1 show assessment summary results for the onshore region, offshore region, and the grand total for all of Bangladesh. The assessment results summary by assessment unit shows, in more detail, resources allocated to onshore and offshore areas as appropriate. In this assessment, offshore areas out to a depth of water of approximately 200 m were assessed. Graphical summaries of assessment results for each AU are shown in Addendum 1, and input data utilized in the probabilistic assessment process are shown in Addendum 2.

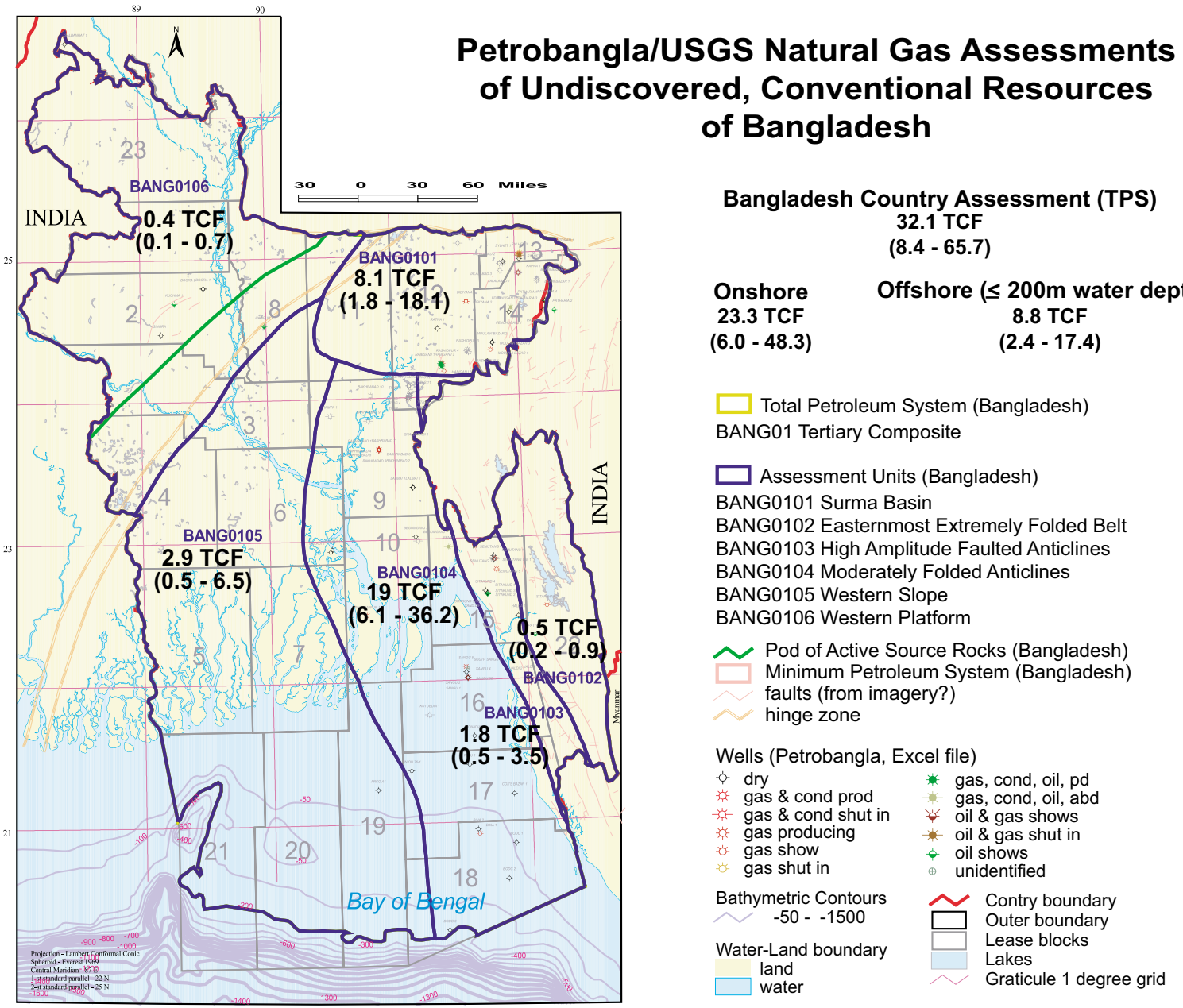

Figure 2. Estimates of undiscovered natural gas resources of Bangladesh. Mean estimate shown with F_{95}–F_5 range shown in parentheses.

Table 1. Stratigraphic nomenclature of Ganges-Brahmaputra delta in eastern India and Bangladesh.

SYSTEM	SERIES	Mishra and Singh (1997)	Ganguly (1997)				
			Age	Shelf and slope facies	Basin facies	Surma Basin	
	Pliocene and Pleistocene					Dupitila Group	U. Dupitila L. Dupitila
TERTIARY	**Late Oligocene to early Pliocene**	Ranaghat Fm. Matla Fm. Debagram Fm. Pandua Fm. Diamond Harbour Fm.	**Pliocene**	Debagram Fm.	Ranaghat Fm.	Tipam Group	Girujan Clay Tipam Fm.
			Miocene	Pandua Fm. Diamond Harbour Fm	Matla Fm.	Surma Group	Bokabil Fm Bhuban Fm.
	Oligocene	Burdwan Fm.	**Oligocene**	Burdwan Fm.		Barail Group	Renji Fm. Jenam Fm. Laisong Fm.
	Eocene	Hoogly Fm. Kalighat Ls.	**Eocene**	Kopili Fm.		Jaintia Group	Kopili Fm. Sylhet Ls.
				Sylhet Ls			
		Jalangi Fm.		Jalangi Fm. (Chera Fm.)			Cherra Fm.
	Paleocene	Ghatal Fm.	**Paleocene**				
CRETACEOUS	**Maastrichtian**	Bolpur Fm.	**Cretaceous**	Ghatal Fm. Bolpur Fm. Rajmahal trap			
	Campanian	Dhananjaypur Fm.					
Permo-Carb.			**Permo-Carb.**	Gondwana			
Archaean			**Pre-cambrian**	Basement			

Part II—Assessment Unit Descriptions

Bang0101: Surma Basin Assessment Unit

The Surma Basin assessment unit is a geophysically and geologically defined area in northeastern Bangladesh that contains a great thickness of Tertiary sedimentary strata. This AU is classified as a frontier area, with nine discovered gas fields that exceed the minimum assessed size of 42 BCFG. The Surma Basin occurs to the south of the Precambrian Shillong Plateau, a crystalline massif that has been thrust up to the south along a footwall of Tertiary sedimentary strata. The basin contains as much as 20,000 m of sedimentary fill and is characterized by a conspicuous 50-milligal negative gravity anomaly. In general, the natural gases produced from this AU contain a greater amount of liquid hydrocarbons than do the gases produced elsewhere in Bangladesh.

The strata that comprise the explored part of the assessment unit in the Surma Basin range in thickness from about 3,000 to 5,000 m (table 1). In general, their lithologies consist of deltaic, estuarine, and shallow-marine sandstones, siltstones, and shales that contain abundant plant-derived organic matter. Potentia- source rocks include shales and carbonaceous shales of Eocene, Oligocene, and Miocene age. These strata generally contain about 0.5 to 3 percent total organic carbon (TOC), although in places the content of organic matter may range up to 10.5 percent. Thermal maturation is sufficient to generate natural gas and natural gas liquids throughout much of the area. Gas and condensates were generated at maturities equivalent to 1.1 to 1.3 percent vitrinite reflectance (R_o) and at depths that range from about 6 to 7.5 km (Unocal Corporation, unpub. data). Little oil has been discovered in a few of the Surma Basin wells. Migration is generally vertical along fractures and through porous strata. Hydrocarbon generation commenced a few tens of millions of years ago and has continued during the formation of the major anticlinal traps, which began forming only several million years ago.

Reservoir rocks in the Surma Basin are chiefly Tertiary-age sandstones of the Boka Bil and Bhuban Formations (Miocene) that were deposited in fluvial, deltaic, and estuarine environments. Porosity generally ranges from 10 to 20 percent. Reservoir sands range from thick channel-fill and littoral or marine-bar deposits to sandstones thinly interlaminated with shale and siltstone that were deposited in tidally influenced environments.

At the top of the Surma Group (table 1), a widespread unit, generally known as the upper marine shale (ums), serves as a regional hydrocarbon seal in the Surma Basin and elsewhere in Bangladesh. The major shale source beds may also serve as regional seals. In addition to the regionally distributed shale beds, there are several more locally distributed shale beds and shale-filled channels in the middle and lower parts of the Surma Group that support stacked reservoirs in several of the known fields.

Structural and combination traps of Miocene age occur along stratigraphic boundaries, in sandstone-filled channel deposits, and in sandstone beds sealed laterally by shale-filled channels—these comprise major traps in the eastern part of the basin. In general, these sedimentary strata have been folded into several large-scale anticlines that are unfaulted or slightly to moderately faulted in the western and central parts of the basin. Folding and faulting is more intense toward the east within the Chittagong-Tripura fold belt and becomes progressively less intense to the west, where the folds are more broad and gentle.

Major field discoveries in this AU include Jalalabad, Beanibazar, Chhatak, Sylhet, Moulavibazar, Rashidpur, Fenchuganj, Bibiyana, Kailashtila, and Habiganj. Graphical summaries of known fields are shown in Addendum 2.

Bang0102: Eastern Extremely Folded Assessment Unit

This assessment unit is classified as hypothetical because hydrocarbons in amounts exceeding the minimum field size have not been found within it. This AU comprises the easternmost and most tectonically deformed AU in Bangladesh. It consists of at least 10 major anticlinal structures that bring strata as old as Miocene to the surface on their crests. The Tertiary-age stratigraphic units mapped in the tightly folded anticlinal structures in this area (Alam and others, 1990) are the same as those recognized in the subsurface of the Surma Basin. As a result of the intense folding and faulting, the source rocks and reservoir rocks of the Surma Basin are exposed at the surface in this area where the anticlines are breached by erosion. The few wells that have been drilled in this area tested the upper part of the Surma Group, and all were plugged and abandoned. The Patiya well near Rangamati, drilled into the Miocene in 1953 by Pakistan Petroleum, Ltd., encountered a show of oil in Miocene strata.

The strata exposed in the anticlinal structures that comprise this assessment unit are about 3,000 m thick (Baqi and others, 1995) In general, their lithologies consist of basinal turbidites and deep- to shallow-marine deposits in the lower part, to shallow-marine and fluvial deposits in the upper part of the exposed stratigraphic section. Bouma sequences have been identified in the lower and middle parts of the exposed stratigraphic section, suggesting deep-water sedimentation, whereas the upper part contains abundant burrows and shallow-water marine fossils that suggest shallow-water sedimentation. Potential source rocks in the exposed part of the section include the marine shales and carbonaceous shales of the Bhuban and Boka Bil Formations (Miocene) and buried source rocks of Oligocene age. The Miocene-age shale-dominated units may be as much as 500 m thick (Baqi and others, 1995). The presence of hydrocarbons in the region indicates that thermal maturation is sufficient to generate natural gas and natural gas liquids throughout much of the area.

Migration is generally vertical along fractures and lateral through porous strata. Hydrocarbon generation commenced a few tens of millions of years ago and has continued during the formation of the major anticlinal traps, which began only about 5 million years ago. Reservoir rocks in the this AU are chiefly Tertiary-age sandstones that were deposited in deep- to shallow-marine environments, and the seals are the interbedded shale-dominated units that, in places, are as much as 500 m thick. Folded marine sandstone beds, sandstone-filled channel deposits, and sandstone beds sealed laterally by shale-filled channels of Miocene age constitute potential traps in the Boka Bil and Bhuban Formations. Because the major structures have been breached by erosion, likely exploration targets would be along the noses of major plunging anticlines where the structures descend into the subsurface and on the smaller anticlinal closures that occur in the synclinal regions between major breached anticlinal structures.

Bang0103: High-Amplitude Faulted Anticlines Assessment Unit

This assessment unit is classified as frontier because it has only one field that exceeds the minimum size of 42 BCFG. The High-Amplitude Faulted Anticlines assessment unit occupies the area east of the Moderately Faulted Anticlines assessment unit and west of the Easternmost Extremely Faulted assessment unit in easternmost Bangladesh. It consists of at least seven major anticlinal structures that bring strata as old as Miocene up to the surface in their cores. The Tertiary-age stratigraphic units mapped in the tightly folded anticlinal structures in this area (Alam and others, 1990) are the same as those recognized in the subsurface of the Surma Basin. As a result of the intense folding and faulting, however, the source rocks and reservoir rocks correlative to those in the Surma Basin are exposed at the surface in this area where the anticlines are breached by erosion. The Semutang field is the only field discovered in this area—by the Pakistan Oil and Gas Development Corporation—and it is not producing. Semutang is located on the plunging nose of an anticline that is breached at least to the level of the Boka Bil Formation to the north, at the Indian border. Prospects at Sitakund and Jaldi have yielded shows of hydrocarbons, and the Haldi prospect was dry.

This assessment unit was separated from Bang0102 because it is not as greatly deformed structurally and contains a discovered gas field. In general, the petroleum geology of the two regions is much the same.

Bang0104: Moderately Folded Anticlines Assessment Unit

This assessment unit is classified as a frontier unit because it has only nine fields that exceed the minimum size of 42 BCFG. The Bengal foredeep, the large area generally to the south of the Surma Basin, is in the more distal region of the thick Tertiary deltaic deposits of the Ganges-Brahmaputra delta. Overall, the sediments of the AU are as thick as 20,000 m in the Patuakhali depression, a depocenter located in the southeastern side of the delta (Shamsuddin and Abdullah, 1997; Ganguly, 1997). Like Bang0102 and Bang0103, the Tertiary and Quaternary strata in this AU are deformed into a series of plunging folds because of subduction beneath the Arakan Yoma geoanticlinorium to the east. In this AU, anticlinal structures range from tightly folded, elongate, and faulted structures on the east to broad, open, relatively unfaulted structures on the west.

The Bengal foredeep contains the great volume of Tertiary sediments of the delta. In general, the basin-fill consists of sandstones, siltstones, and shales that commonly contain plant-derived organic matter. The strata that comprise this AU are more distal equivalents of the Oligocene Barail Group, the Miocene Surma Group, and the Pliocene Tipam Group in the Surma Basin and in the folded belts to the east. Current drilling depths generally range from about 3.5 to 4.5 km in the southeastern part of the delta.

Cairn Energy and Shell Bangladesh have devised an informal megasequence classification for the strata in the southern and offshore regions of Bangladesh. The megasequences are identified on seismic cross sections, and they are based upon the overall character of their bed forms. In general, megasequence 1 (MS 1) at the base of seismically imaged sections consists of major progradational bed forms that are overlain by generally subhorizontal aggradational bed forms. These bed forms are overlain by the highly channelized and canyonized bed forms of megasequence 2 (MS 2). Regionally, the channel-like bed forms in MS 2 may represent (1) deeply eroded submarine canyons in the more distal, southern part of the delta and (2) filled subaerial valleys of much less local relief in the northern part of the AU and in the adjacent Surma Basin. The upper part of the section, represented by megasequence 3 (MS 3), consists also of progradational and aggradational bed forms generally similar to those of MS 1.

In the nearshore and offshore areas of southeastern Bangladesh, about 1 to 1.5 km of MS 1 are imaged at the base of the seismic sections, MS 2 is about 2.5 km thick, and MS 3 at the top of the seismic sections may be as thick as 1 km. The Miocene-Pliocene boundary has been identified as near the middle of MS 2 using biostratigraphic markers. If this is correct, then the Tipam and Dupitila Groups in BANG0104 to the east would be approximately equivalent to MS 2.

Although the source rocks in this area have not been identified with certainty, they probably contain woody organic matter in shale, shaly coal beds, and coal from deeper Miocene and Oligocene source rocks. The stratigraphic positions of the source beds are uncertain, and the hydrocarbons may be generated from relatively low concentrations of organic matter distributed throughout a large volume of sediments. In addition, there is some evidence of potential marine source rocks and more deeply buried Oligocene source rocks beneath the

levels currently imaged on seismic reflection data. Potential source rocks from Oligocene to mid-Miocene age are within or have passed through the main gas-generating window prior to and during the development of the major anticlines. The low concentration of liquid hydrocarbons in fields from the southern limit of the Surma Basin to offshore southeastern Bangladesh demonstrates that source rocks, wherever they are, are at an appropriate level of thermal maturation to have generated large amounts of natural gas. Migration pathways are complex and are generally vertical along faults and fractures and via gas chimneys, and lateral through porous sandstones. Overpressured zones at depth may be a control on migration and may impact seal integrity. Such zones are believed to have significant future potential for gas resources in Bangladesh. Future discoveries are expected within this overpressured zone, roll-over anticlines in extensional down-to-the-basin structures, and in a great variety of stratigraphic and combination traps, many near known structures.

Reservoir rocks are in deltaic, littoral, and marine sandstones in the upper part of MS 1 and in the sandstone channel-fill deposits of MS 2. Porosity ranges generally from 10 to 25 percent. Evidence from onshore sections to the east indicate that some of these Tertiary strata may have been deposited as turbidites in relatively deep water.

Major discoveries in this assessment unit include the following fields: Titas, Bakhrabad, Megna, Narsingdi, Shaldanadi, Kamta, Feni, Shahbazpur, Kutubdia, and Sangu. Data on those fields are shown in Addendum 2.

Bang0105: Western Slope Assessment Unit

The Western Slope assessment unit occupies the region between the Moderately Faulted Anticlines assessment unit on the east and the Western Platform assessment unit on the west. It is classified as hypothetical because no gas fields larger than 42 BCFG have been found in this sparsely explored area . Tectonically, the region is generally unfolded, and the major structures appear to be extensional rather than compressional. The Tertiary strata of the assessment unit apparently overlie extended and thinned (transitional) continental crust in the northern part of the AU, and oceanic crust in nearshore and offshore regions to the south. All told, the sedimentary strata in this AU range from about 7 km thick along the edge of the slope to perhaps several tens of kilometers thick in the offshore region of Bangladesh. The possibility of deep-marine sediments—submarine fans—at the base of prograding clonoforms seaward of a paleo hinge line were also considered in this AU.

Sedimentary input into this part of the Bengal Basin consists of components from two major source areas, the Precambrian Indian craton on the west and the tectonic highlands of the Himalayan Mountains and, perhaps, the Arakan Yoma on the north and east, respectively. Basement east of the Tertiary shelf edge in Bangladesh most likely consists of Precambrian igneous and metamorphic rocks that have been intermittently deformed, extended, and thinned by extensional forces from the Permian through the Cretaceous. Overlying fine-grained siliciclastic strata of early Tertiary age, perhaps interbedded with a few thin limestones, appear to have been deposited as eastward-prograding wedges along the margin of the northward-drifting subcontinent. As the Indian subcontinent closed with the southern part of the Asian continent, anoxia may have developed in the ever-restricted deep basin of the Tethys sea prior to collision so that oil-prone source rocks developed in the deep basin to the east of the Tertiary shelf edge. After collision of the Indian subcontinent with Asia and the development of tectonic highlands to the north and east, these older, westward-derived strata were covered by the younger Tertiary and Quaternary clastic deposits of the developing Ganges-Brahmaputra River system. These younger strata are most likely direct correlatives with the megasequences described in the AU to the east. Accordingly, potential source rocks, seals, and reservoirs are expected to be similar to those in Bang0104. Some geologic risk of not finding an accumulation greater than 42 BCFG was accommodated because only one unsuccessful exploratory test has been drilled, and the area is essentially untested.

This AU has not been compressionally deformed by the processes of crustal subduction that has deformed easternmost Bangladesh. Major compressional structures are absent, and expected structural traps will be related to extensional deformation, where listric down-to-the-basin faults have resulted in the formation of roll-over anticlines. These extensional faults may provide vertical migration pathways for hydrocarbons that matured in more deeply buried source rocks. Stratigraphic traps are anticipated to be abundant, and charging with hydrocarbons is expected to have occurred early in the depositional history of this part of the basin as potential source rocks and porous reservoirs were buried ever more deeply within the sedimentary basin.

Thus far, this large region of the delta has been little explored, and no discoveries have been made therein.

Bang0106: Western Platform Assessment Unit

This assessment unit is classified as hypothetical since no fields have been found that exceed the minimum field size of 42 BCFG. In northwestern Bangladesh, the Western Platform assessment unit consists of several buried regional geologic structures. These structures are the eastward-inclined Bogra shelf of early Tertiary age that is terminated on the east by a paleo hinge line, a buried structural saddle adjacent to the Shillong Plateau, and a small area in northwesternmost Bangladesh that dips northwest into the Himalayan foredeep. This area was assessed collectively as the Western Platform assessment unit. Collectively, the Mesozoic and Cenozoic strata in this area are about 5 to 7 km thick and consist both of pre-collisional sequences that were deposited prior to and during the northward drift of the Indian subcontinent and the post-collisional sequences that were deposited in mid- to late-Ter-

tiary time. As in the previous assessment unit, early Tertiary strata consist of several hundred meters of siliciclastic and carbonate rock that in places serve as potential source rocks and reservoirs. Although overlying Tertiary strata are dominated by sandstones and siltstones of good reservoir quality, the capacity for seals within these rocks has not been demonstrated. These strata have been drilled in numerous places in West Bengal, India, and in a few places in western Bangladesh. Although prospects and leads have been identified along unconformities, in porous limestones, and along extensional structures, only a few shows of hydrocarbons have been discovered thus far. The most prospective areas of this assessment unit may be along the shelf edge, where hydrocarbons generated in the adjacent deep basin have migrated upward into traps to the west. Analogous geologic settings in West Bengal, India, appear to have a modest hydrocarbon potential.

The Western Platform assessment unit is underlain at depth by a Permian coal petroleum system, which may contain coal-bed gas in continuous accumulations within extensional Gondwana basins. This petroleum system was not assessed in this study.

Perspective of the Assessment

The six assessment units defined in this study use known geological and engineering information as a basis for estimating the technically recoverable, conventional, undiscovered gas resources of Bangladesh. The resource numbers calculated indicate the range of probable resources that may be discovered if Bangladesh were actively explored during a 30-year time frame. In places, where detailed geologic information is lacking in Bangladesh, the assessment team used geological play types that occur in similar geological provinces elsewhere in the world as analogs for potential hydrocarbon occurrences in Bangladesh. In addition to the fairly well understood structural anticlines, which have thus far constituted the main play in Bangladesh, the assessment team recognized the potential offered by stratigraphic traps; plays at depth within the high-pressure zone; and traps associated with turbidite formations, carbonate reefs and build-ups, buried hill plays, extensional down-to-the-basin faults and associated roll-over anticlines, etc. It is anticipated that, during the next 30 years, each of these play concepts will be explored and tested, at least to some extent, so that the hydrocarbon potential of Bangladesh will be more completely realized.

The assessment team also considered the possible technological advances that may occur within this 30-year time frame that would allow explorationists to visualize and understand subsurface accumulations of hydrocarbons better than they do today. In addition, improvement of production technologies may well add a considerable volume of already-discovered hydrocarbons to the recoverable resource base. These projected advances in technology are based upon our past experience in the evolution of technology as we continually increase our ability to understand the complexities of petroleum geology and to improve our capabilities for exploration and extraction.

The assessment team assumed a minimum field size of 42 BCFG (7 million barrels of oil equivalent (MMBOE)) for this assessment. This minimum field size is anticipated to become economic some time in the future if sufficient infrastructure is constructed.

This country-based study is the first step in a continuous assessment process that is expected to be replicated and updated with additional information generated since the previous assessment. With each subsequent assessment, greater levels of refinement will result in a better level of confidence and more accurate probability distributions for the remaining undiscovered gas resources of Bangladesh.

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Addendum 1

Assessment Results Summary

Petrobangla/USGS Joint Assessment of Gas in Bangladesh
Assessment Results Summary

[BCFG, billion cubic feet of gas. MMBNGL, million barrels of natural gas liquids. MFS, minimum field size assessed (BCFG). Prob., probability (including both geologic and accessibility probabilities) of at least one field equal to or greater than the MFS. Results shown are fully risked estimates. For gas fields, all liquids are included under the NGL (natural gas liquids) category. F95 represents a 95 percent chance of at least the amount tabulated. Other fractiles are defined similarly. Fractiles are additive under the assumption of perfect positive correlation]

Code and Field Type	MFS (BCFG)	Prob. (0-1)	Undiscovered Resources							
			Gas (BCFG)				NGL (MMBNGL)			
			F95	F50	F5	Mean	F95	F50	F5	Mean
Total: Onshore portions of Bangladesh										
Gas Fields	42	1.00	5,989	21,116	48,336	23,339	25	97	265	114
Total: Offshore portions of Bangladesh (to 200 m water depth)										
Gas Fields	42	1.00	2,442	8,055	17,367	8,777	4	16	42	18
Grand Total: Bangladesh										
Gas Fields	42	1.00	8,431	29,171	65,703	32,116	29	113	307	132

Petrobangla/USGS Joint Assessment of Gas in Bangladesh
Assessment Results Summary

[BCFG, billion cubic feet of gas. MMBNGL, million barrels of natural gas liquids. MFS, minimum field size assessed (BCFG). Prob., probability (including both geologic and accessibility probabilities) of at least one field equal to or greater than the MFS. Results shown are fully risked estimates. For gas fields, all liquids are included under the NGL (natural gas liquids) category. F95 represents a 95 percent chance of at least the amount tabulated. Other fractiles are defined similarly. Fractiles are additive under the assumption of perfect positive correlation]

Code and Field Type	MFS (BCFG)	Prob. (0-1)	Undiscovered Resources							
			Gas (BCFG)				NGL (MMBNGL)			
			F95	F50	F5	Mean	F95	F50	F5	Mean
BANG01	**Tertiary Composite Total Petroleum System**									
BANG0101	Surma Basin Assessment Unit									
Gas Fields	42	1.00	1,805	7,120	18,068	8,140	17	69	189	81
BANG0102	Easternmost Extremely Folded Belt Assessment Unit									
Gas Fields	42	0.70	0	366	868	358	0	<0.5	1	<0.5
BANG0103	High Amplitude Faulted Anticlines Assessment Unit									
Gas Fields	42	1.00	521	1,611	3,485	1,762	1	3	8	4
BANG0104	Moderately Folded Anticlines Assessment Unit (60% allocated to ONSHORE portion)									
Gas Fields	42	1.00	3,663	10,571	21,728	11,406	7	21	52	24
BANG0104	Moderately Folded Anticlines Assessment Unit (40% allocated to OFFSHORE portion)									
Gas Fields	42	1.00	2,442	7,047	14,486	7,604	4	14	35	16
BANG0105	Western Shelf Assessment Unit (55% allocated to ONSHORE portion)									
Gas Fields	42	0.90	0	1,233	3,521	1,433	0	2	8	3
BANG0105	Western Shelf Assessment Unit (45% allocated to OFFSHORE portion)									
Gas Fields	42	0.90	0	1,008	2,881	1,173	0	2	7	2
BANG0106	Western Platform Assessment Unit									
Gas Fields	42	0.64	0	215	666	240	0	2	7	2

Assessment Unit Bang0101
Surma Basin
Monte Carlo Results

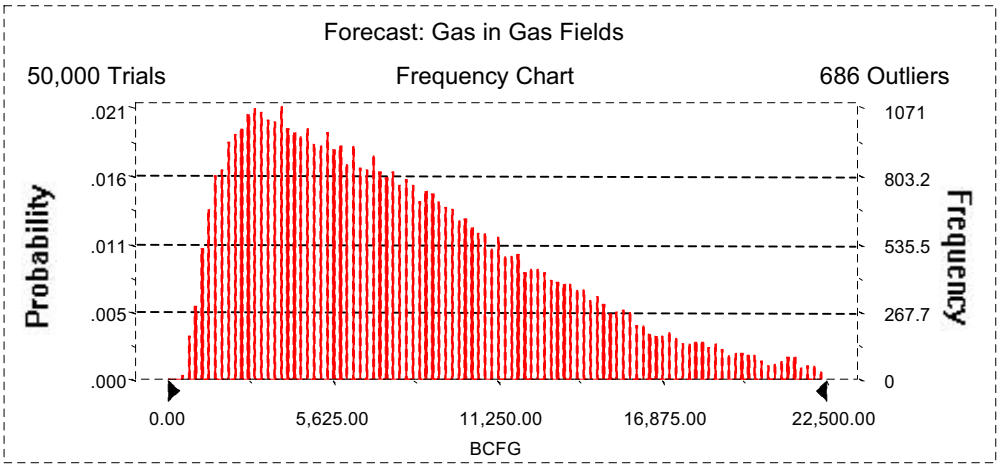
Assessment Unit BANG0101
Surma Basin
Monte Carlo Results

Forecast: Gas in Gas Fields

Summary:

Display range is from 0.00 to 22,500.00 BCFG
Entire range is from 438.77 to 42,121.10 BCFG
After 50,000 trials, the standard error of the mean is 23.11

Statistics:	Value
Trials	50000
Mean	8,139.65
Median	7,119.87
Mode	---
Standard Deviation	5,168.02
Variance	26,708,466.53
Skewness	1.02
Kurtosis	4.08
Coefficient of Variability	0.63
Range Minimum	438.77
Range Maximum	42,121.10
Range Width	41,682.34
Mean Standard Error	23.11



Assessment Unit BANG0101
Surma Basin
Monte Carlo Results

Forecast: Gas in Gas Fields (cont'd)

Percentiles:

Percentile	BCFG
100%	438.77
95%	1,805.33
90%	2,429.61
85%	2,977.54
80%	3,517.21
75%	4,057.01
70%	4,631.82
65%	5,223.53
60%	5,822.78
55%	6,460.90
50%	7,119.87
45%	7,813.64
40%	8,530.25
35%	9,313.89
30%	10,162.64
25%	11,120.65
20%	12,246.29
15%	13,604.86
10%	15,278.96
5%	18,067.89
0%	42,121.10

End of Forecast

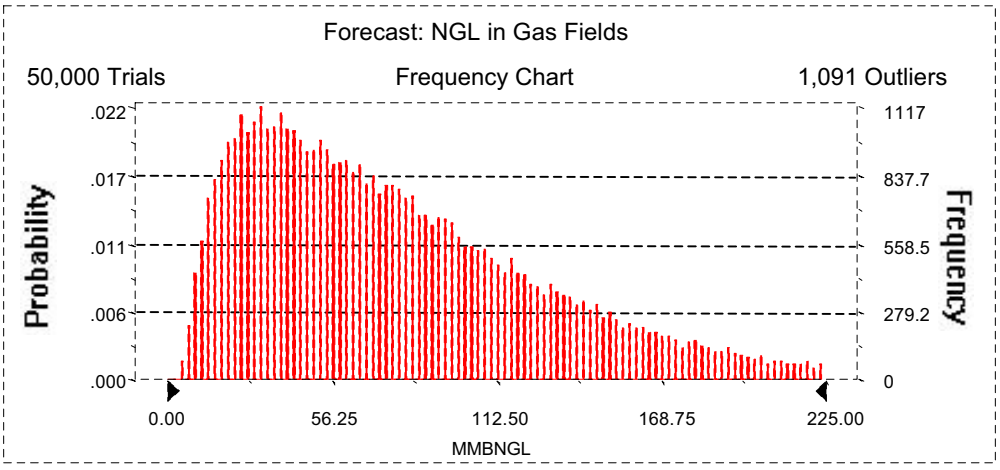
Assessment Unit BANG0101
Surma Basin
Monte Carlo Results

Forecast: NGL in Gas Fields

Summary:

Display range is from 0.00 to 225.00 MMBNGL
Entire range is from 3.72 to 432.87 MMBNGL
After 50,000 trials, the standard error of the mean is 0.25

Statistics:	Value
Trials	50000
Mean	81.45
Median	69.14
Mode	---
Standard Deviation	55.16
Variance	3,042.88
Skewness	1.22
Kurtosis	4.78
Coefficient of Variability	0.68
Range Minimum	3.72
Range Maximum	432.87
Range Width	429.15
Mean Standard Error	0.25



Assessment Unit BANG0101
Surma Basin
Monte Carlo Results

Forecast: NGL in Gas Fields (cont'd)

Percentiles:

Percentile	MMBNGL
100%	3.72
95%	16.97
90%	23.07
85%	28.45
80%	33.69
75%	39.09
70%	44.44
65%	50.26
60%	56.18
55%	62.48
50%	69.14
45%	76.15
40%	83.41
35%	91.55
30%	100.38
25%	110.74
20%	122.77
15%	137.63
10%	157.04
5%	188.99
0%	432.87

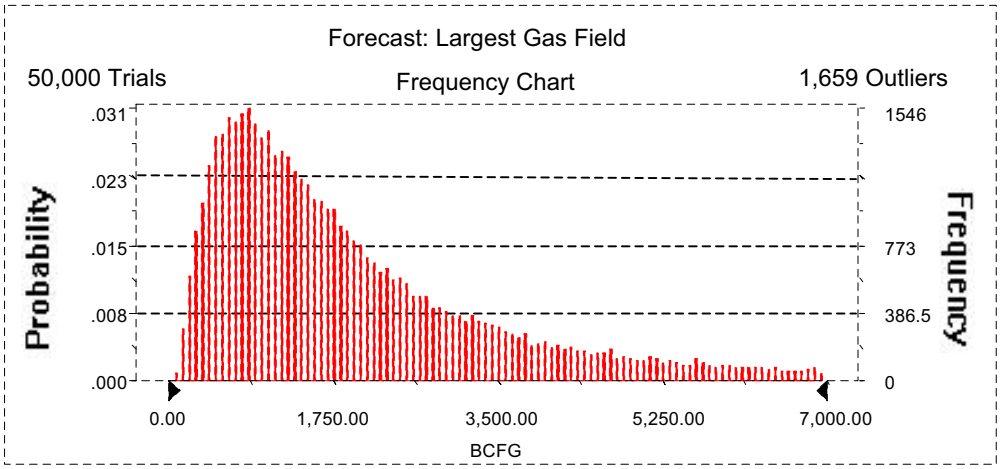
End of Forecast

Assessment Unit BANG0101
Surma Basin
Monte Carlo Results

Forecast: Largest Gas Field

Summary:
Display range is from 0.00 to 7,000.00 BCFG
Entire range is from 56.91 to 9,988.54 BCFG
After 50,000 trials, the standard error of the mean is 8.15

Statistics:	Value
Trials	50000
Mean	2,157.25
Median	1,574.82
Mode	---
Standard Deviation	1,823.21
Variance	3,324,105.68
Skewness	1.72
Kurtosis	6.01
Coefficient of Variability	0.85
Range Minimum	56.91
Range Maximum	9,988.54
Range Width	9,931.63
Mean Standard Error	8.15



Assessment Unit BANG0101
Surma Basin
Monte Carlo Results

Forecast: Largest Gas Field (cont'd)

Percentiles:

Percentile	BCFG
100%	56.91
95%	395.64
90%	536.30
85%	659.93
80%	777.69
75%	891.78
70%	1,012.64
65%	1,140.35
60%	1,272.68
55%	1,417.82
50%	1,574.82
45%	1,749.86
40%	1,944.09
35%	2,169.99
30%	2,447.15
25%	2,778.96
20%	3,220.65
15%	3,778.87
10%	4,663.12
5%	6,181.70
0%	9,988.54

End of Forecast

Assessment Unit BANG0101
Surma Basin
Monte Carlo Results

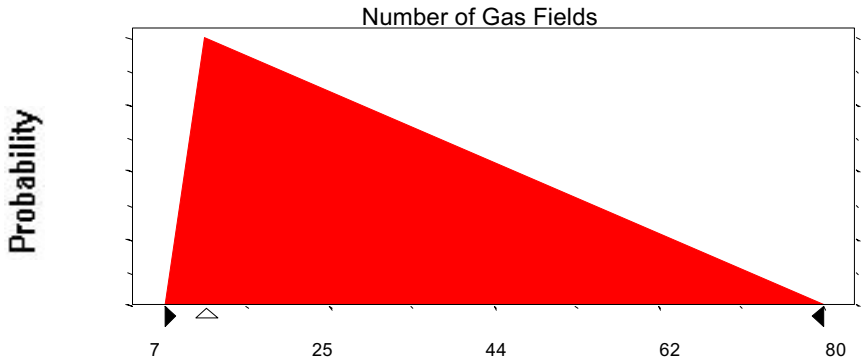
Assumptions

Assumption: Number of Gas Fields

Triangular distribution with parameters:

Minimum	7
Likeliest	12
Maximum	80

Selected range is from 7 to 80
Mean value in simulation was 33



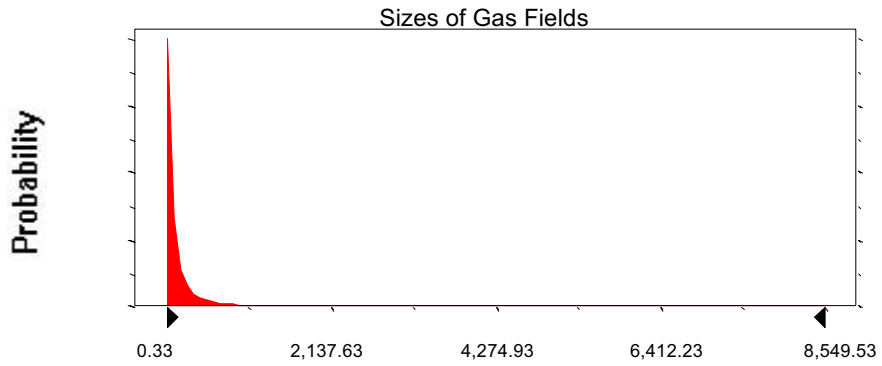
Assumption: Sizes of Gas Fields

Lognormal distribution with parameters:		Shifted parameters
Mean	222.71	264.71
Standard Deviation	908.95	908.95

Selected range is from	0.00 to 9,958.00	42.00 to 10,000.00
Mean value in simulation was	203.29	245.29

Assessment Unit BANG0101
Surma Basin
Monte Carlo Results

Assumption: Sizes of Gas Fields (cont'd)

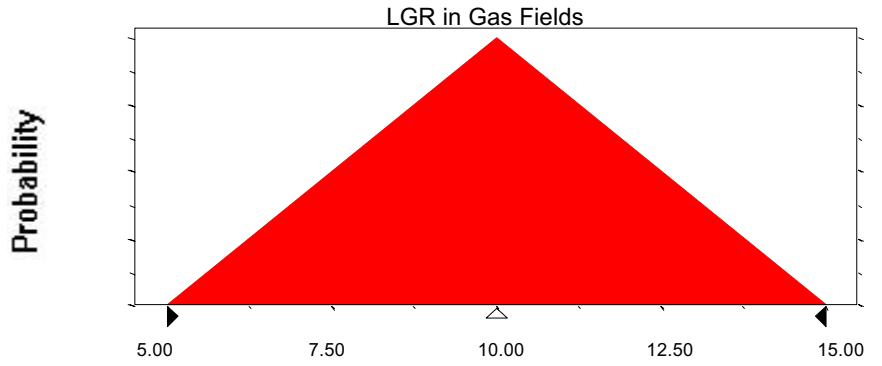


Assumption: LGR in Gas Fields

Triangular distribution with parameters:

Minimum	5.00
Likeliest	10.00
Maximum	15.00

Selected range is from 5.00 to 15.00
Mean value in simulation was 10.01



End of Assumptions

Simulation started on 1/25/01 at 19:16:10
Simulation stopped on 1/25/01 at 19:39:56

Assessment Unit Bang0102
Eastern Extremely Folded Belt
Monte Carlo Results

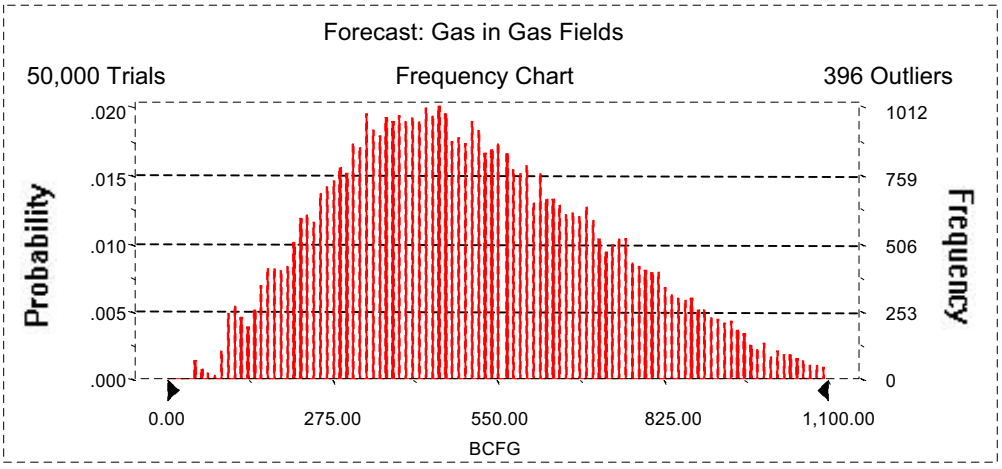
Assessment Unit BANG0102
Eastern Extremely Folded Belt
Monte Carlo Results

Forecast: Gas in Gas Fields

Summary:

Display range is from 0.00 to 1,100.00 BCFG
Entire range is from 44.04 to 1,667.61 BCFG
After 50,000 trials, the standard error of the mean is 1.00

Statistics:	Value
Trials	50000
Mean	511.82
Median	487.50
Mode	---
Standard Deviation	222.76
Variance	49,622.89
Skewness	0.48
Kurtosis	2.88
Coefficient of Variability	0.44
Range Minimum	44.04
Range Maximum	1,667.61
Range Width	1,623.57
Mean Standard Error	1.00



Assessment Unit BANG0102
Eastern Extremely Folded Belt
Monte Carlo Results

Forecast: Gas in Gas Fields (cont'd)

Percentiles:

Percentile	BCFG
100%	44.04
95%	182.70
90%	238.32
85%	279.55
80%	314.19
75%	344.61
70%	373.81
65%	402.33
60%	430.80
55%	458.35
50%	487.50
45%	517.78
40%	549.40
35%	582.43
30%	619.59
25%	659.93
20%	704.58
15%	757.31
10%	819.56
5%	911.57
0%	1,667.61

End of Forecast

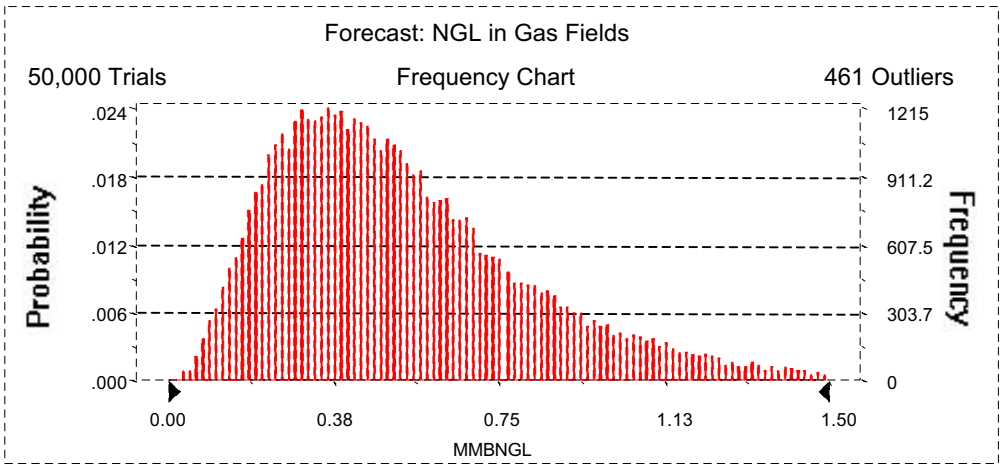
Assessment Unit BANG0102
Eastern Extremely Folded Belt
Monte Carlo Results

Forecast: NGL in Gas Fields

Summary:

Display range is from 0.00 to 1.50 MMBNGL
Entire range is from 0.03 to 2.36 MMBNGL
After 50,000 trials, the standard error of the mean is 0.00

Statistics:	Value
Trials	50000
Mean	0.54
Median	0.48
Mode	---
Standard Deviation	0.30
Variance	0.09
Skewness	1.13
Kurtosis	4.62
Coefficient of Variability	0.56
Range Minimum	0.03
Range Maximum	2.36
Range Width	2.33
Mean Standard Error	0.00



Assessment Unit BANG0102
Eastern Extremely Folded Belt
Monte Carlo Results

Forecast: NGL in Gas Fields (cont'd)

Percentiles:

Percentile	MMBNGL
100%	0.03
95%	0.17
90%	0.21
85%	0.25
80%	0.29
75%	0.32
70%	0.35
65%	0.38
60%	0.41
55%	0.45
50%	0.48
45%	0.52
40%	0.55
35%	0.60
30%	0.64
25%	0.69
20%	0.76
15%	0.84
10%	0.95
5%	1.13
0%	2.36

End of Forecast

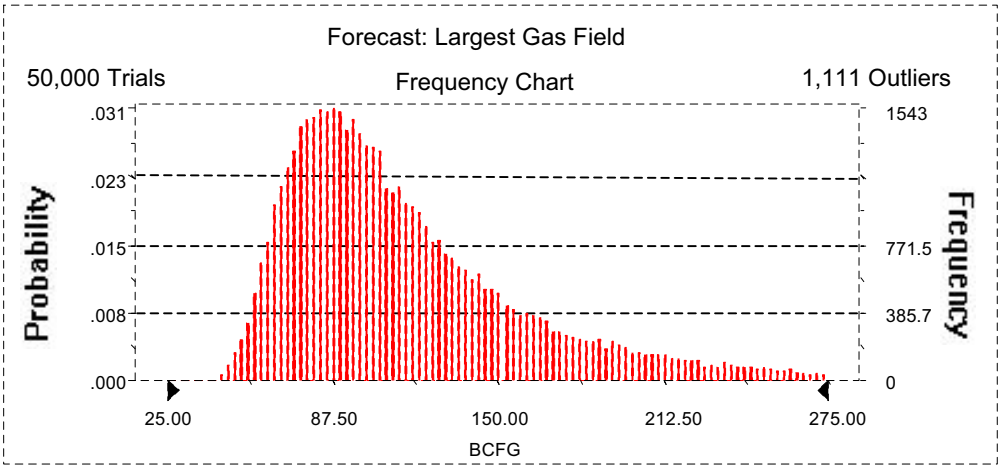
Assessment Unit BANG0102
Eastern Extremely Folded Belt
Monte Carlo Results

Forecast: Largest Gas Field

Summary:

Display range is from 25.00 to 275.00 BCFG
Entire range is from 44.04 to 399.48 BCFG
After 50,000 trials, the standard error of the mean is 0.24

Statistics:	Value
Trials	50000
Mean	119.58
Median	105.04
Mode	---
Standard Deviation	53.14
Variance	2,823.49
Skewness	1.78
Kurtosis	7.05
Coefficient of Variability	0.44
Range Minimum	44.04
Range Maximum	399.48
Range Width	355.44
Mean Standard Error	0.24



Assessment Unit BANG0102
Eastern Extremely Folded Belt
Monte Carlo Results

Forecast: Largest Gas Field (cont'd)

Percentiles:

Percentile	BCFG
100%	44.04
95%	63.85
90%	70.11
85%	75.06
80%	79.35
75%	83.50
70%	87.58
65%	91.67
60%	95.94
55%	100.33
50%	105.04
45%	110.32
40%	116.15
35%	122.59
30%	130.16
25%	139.33
20%	150.48
15%	165.69
10%	188.34
5%	227.24
0%	399.48

End of Forecast

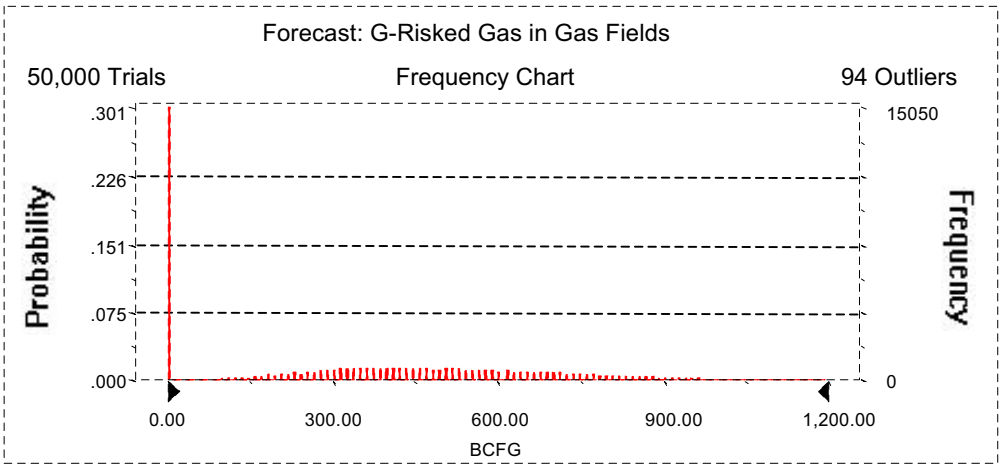
Assessment Unit BANG0102
Eastern Extremely Folded Belt
Monte Carlo Results

Forecast: G-Risked Gas in Gas Fields

Summary:

Display range is from 0.00 to 1,200.00 BCFG
Entire range is from 0.00 to 1,667.61 BCFG
After 50,000 trials, the standard error of the mean is 1.34

Statistics:	Value
Trials	50000
Mean	358.08
Median	365.69
Mode	0.00
Standard Deviation	300.03
Variance	90,020.09
Skewness	0.31
Kurtosis	2.16
Coefficient of Variability	0.84
Range Minimum	0.00
Range Maximum	1,667.61
Range Width	1,667.61
Mean Standard Error	1.34



Assessment Unit BANG0102
Eastern Extremely Folded Belt
Monte Carlo Results

Forecast: G-Risked Gas in Gas Fields (cont'd)

Percentiles:

Percentile	BCFG
100%	0.00
95%	0.00
90%	0.00
85%	0.00
80%	0.00
75%	0.00
70%	0.00
65%	208.54
60%	272.85
55%	322.01
50%	365.69
45%	406.61
40%	446.58
35%	487.48
30%	531.42
25%	578.59
20%	630.81
15%	692.70
10%	764.70
5%	868.50
0%	1,667.61

End of Forecast

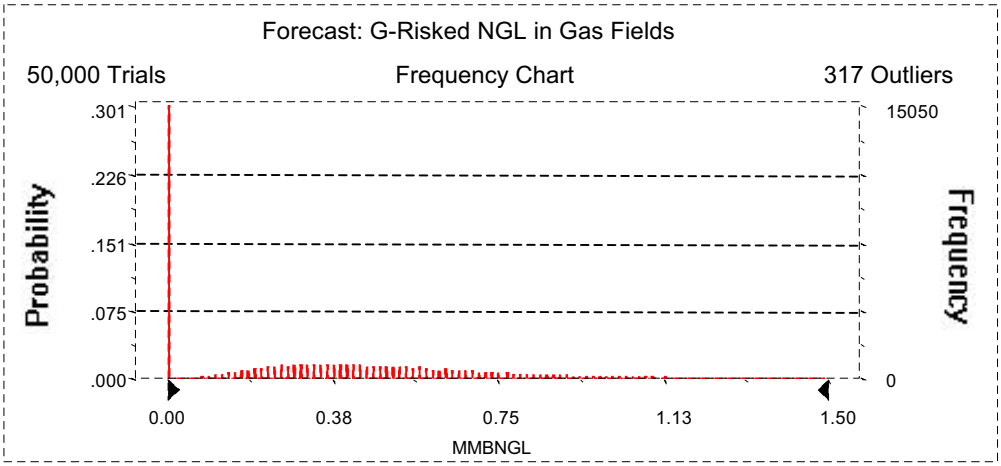
Assessment Unit BANG0102
Eastern Extremely Folded Belt
Monte Carlo Results

Forecast: G-Risked NGL in Gas Fields

Summary:

Display range is from 0.00 to 1.50 MMBNGL
Entire range is from 0.00 to 2.36 MMBNGL
After 50,000 trials, the standard error of the mean is 0.00

Statistics:	Value
Trials	50000
Mean	0.38
Median	0.34
Mode	0.00
Standard Deviation	0.35
Variance	0.13
Skewness	0.89
Kurtosis	3.69
Coefficient of Variability	0.94
Range Minimum	0.00
Range Maximum	2.36
Range Width	2.36
Mean Standard Error	0.00



Assessment Unit BANG0102
Eastern Extremely Folded Belt
Monte Carlo Results

Forecast: G-Risked NGL in Gas Fields (cont'd)

Percentiles:

Percentile	MMBNGL
100%	0.00
95%	0.00
90%	0.00
85%	0.00
80%	0.00
75%	0.00
70%	0.00
65%	0.19
60%	0.25
55%	0.30
50%	0.34
45%	0.39
40%	0.43
35%	0.48
30%	0.53
25%	0.59
20%	0.66
15%	0.74
10%	0.86
5%	1.05
0%	2.36

End of Forecast

Assessment Unit BANG0102
Eastern Extremely Folded Belt
Monte Carlo Results

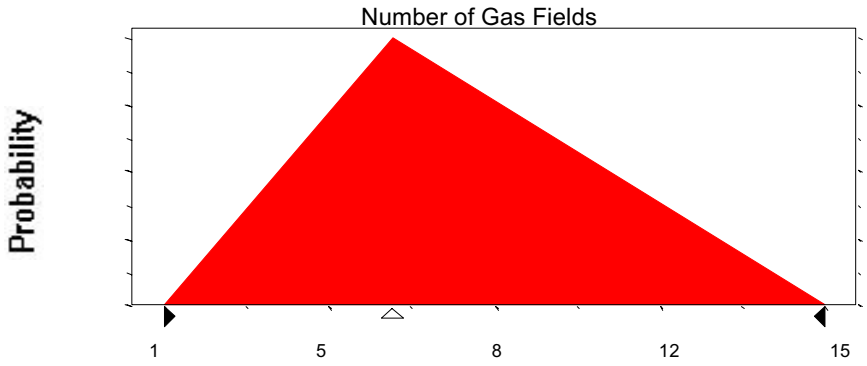
Assumptions

Assumption: Number of Gas Fields

Triangular distribution with parameters:

Minimum	1
Likeliest	6
Maximum	15

Selected range is from 1 to 15
Mean value in simulation was 7

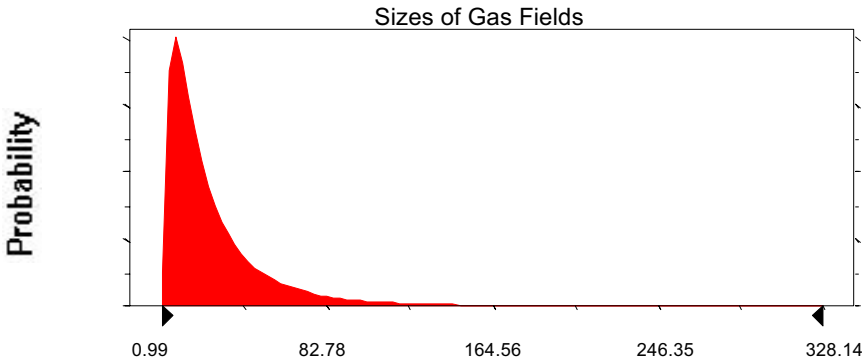


Assumption: Sizes of Gas Fields

Lognormal distribution with parameters:		Shifted parameters
Mean	28.75	70.75
Standard Deviation	35.80	35.80
Selected range is from	0.00 to 358.00	42.00 to 400.00
Mean value in simulation was	28.34	70.34

Assessment Unit BANG0102
Eastern Extremely Folded Belt
Monte Carlo Results

Assumption: Sizes of Gas Fields (cont'd)

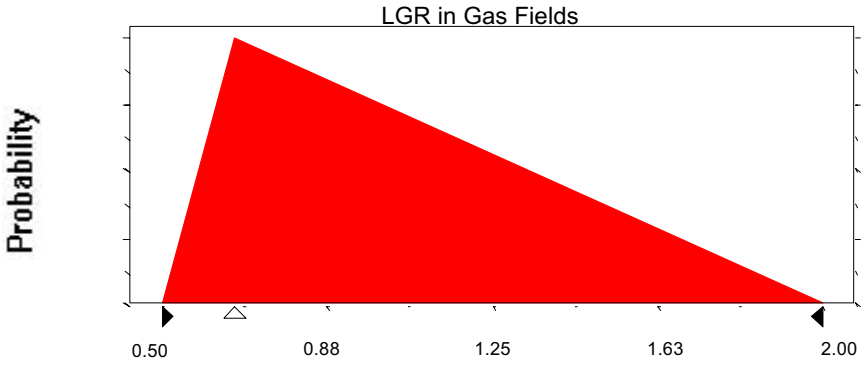


Assumption: LGR in Gas Fields

Triangular distribution with parameters:

Minimum	0.50
Likeliest	0.67
Maximum	2.00

Selected range is from 0.50 to 2.00
Mean value in simulation was 1.06



End of Assumptions

Simulation started on 1/25/01 at 19:48:49
Simulation stopped on 1/25/01 at 20:01:49

Assessment Unit Bang0103
High-Amplitude Faulted Anticlines
Monte Carlo Results

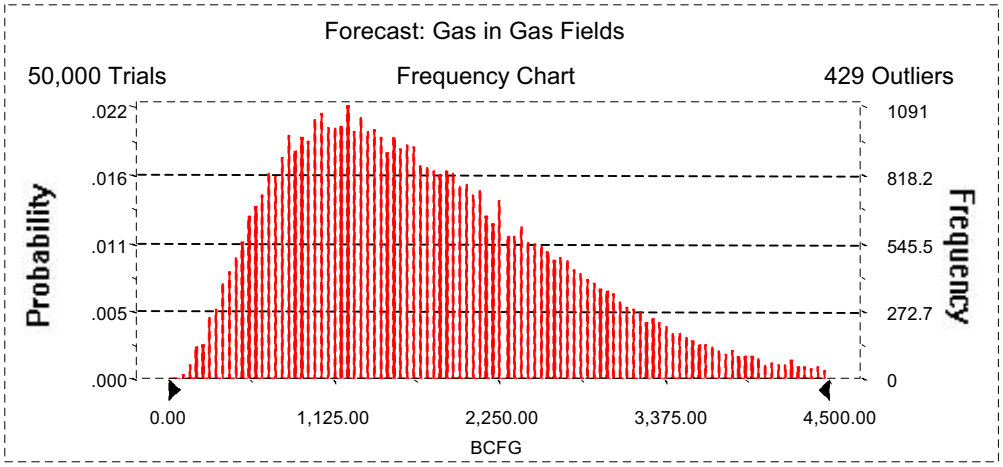
Assessment Unit BANG0103
High-Amplitude Faulted Anticlines
Monte Carlo Results

Forecast: Gas in Gas Fields

Summary:

Display range is from 0.00 to 4,500.00 BCFG
Entire range is from 91.11 to 6,910.01 BCFG
After 50,000 trials, the standard error of the mean is 4.17

Statistics:	Value
Trials	50000
Mean	1,761.63
Median	1,611.47
Mode	---
Standard Deviation	931.80
Variance	868,249.45
Skewness	0.82
Kurtosis	3.62
Coefficient of Variability	0.53
Range Minimum	91.11
Range Maximum	6,910.01
Range Width	6,818.91
Mean Standard Error	4.17



Assessment Unit BANG0103
High-Amplitude Faulted Anticlines
Monte Carlo Results

Forecast: Gas in Gas Fields (cont'd)

Percentiles:

Percentile	BCFG
100%	91.11
95%	520.82
90%	685.68
85%	817.15
80%	935.95
75%	1,048.98
70%	1,157.63
65%	1,266.83
60%	1,376.76
55%	1,491.62
50%	1,611.47
45%	1,736.24
40%	1,869.45
35%	2,008.32
30%	2,156.42
25%	2,329.86
20%	2,527.63
15%	2,752.00
10%	3,044.63
5%	3,485.33
0%	6,910.01

End of Forecast

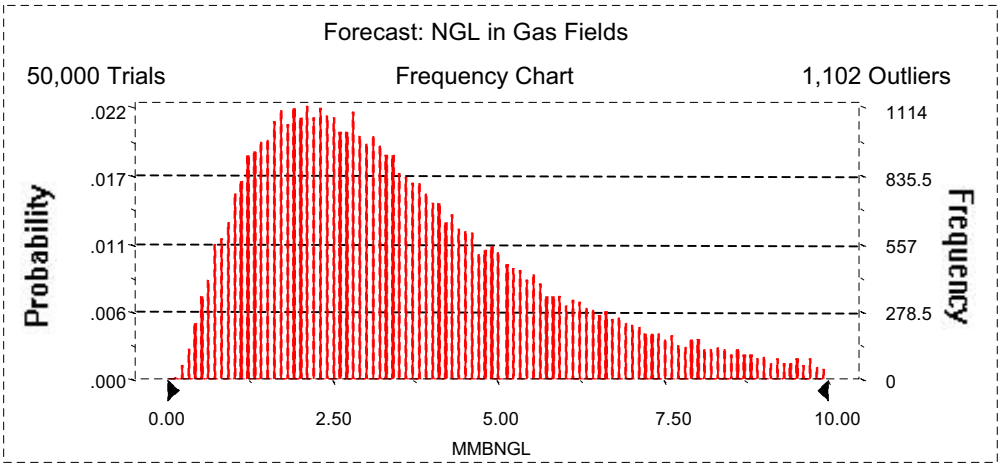
Assessment Unit BANG0103
High-Amplitude Faulted Anticlines
Monte Carlo Results

Forecast: NGL in Gas Fields

Summary:

Display range is from 0.00 to 10.00 MMBNGL
Entire range is from 0.13 to 22.39 MMBNGL
After 50,000 trials, the standard error of the mean is 0.01

Statistics:	Value
Trials	50000
Mean	3.72
Median	3.18
Mode	---
Standard Deviation	2.38
Variance	5.67
Skewness	1.39
Kurtosis	5.77
Coefficient of Variability	0.64
Range Minimum	0.13
Range Maximum	22.39
Range Width	22.26
Mean Standard Error	0.01



Assessment Unit BANG0103
High-Amplitude Faulted Anticlines
Monte Carlo Results

Forecast: NGL in Gas Fields (cont'd)

Percentiles:

Percentile	MMBNGL
100%	0.13
95%	0.93
90%	1.25
85%	1.52
80%	1.75
75%	1.99
70%	2.22
65%	2.45
60%	2.68
55%	2.92
50%	3.18
45%	3.45
40%	3.74
35%	4.07
30%	4.44
25%	4.88
20%	5.38
15%	6.04
10%	6.92
5%	8.37
0%	22.39

End of Forecast

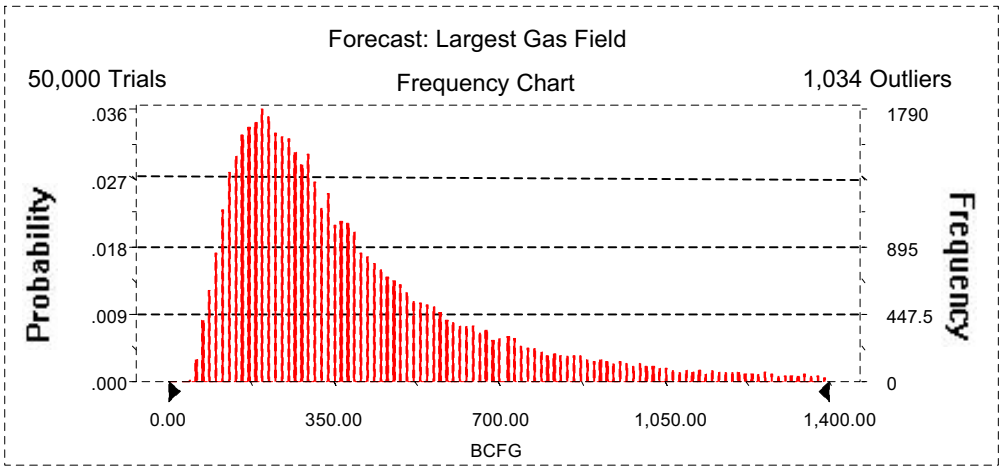
Assessment Unit BANG0103
High-Amplitude Faulted Anticlines
Monte Carlo Results

Forecast: Largest Gas Field

Summary:

Display range is from 0.00 to 1,400.00 BCFG
Entire range is from 46.35 to 1,999.84 BCFG
After 50,000 trials, the standard error of the mean is 1.40

Statistics:	Value
Trials	50000
Mean	416.79
Median	319.78
Mode	---
Standard Deviation	312.71
Variance	97,785.84
Skewness	1.96
Kurtosis	7.55
Coefficient of Variability	0.75
Range Minimum	46.35
Range Maximum	1,999.84
Range Width	1,953.49
Mean Standard Error	1.40



Assessment Unit BANG0103
High-Amplitude Faulted Anticlines
Monte Carlo Results

Forecast: Largest Gas Field (cont'd)

Percentiles:

Percentile	BCFG
100%	46.35
95%	118.02
90%	144.31
85%	166.59
80%	187.33
75%	207.46
70%	227.44
65%	248.86
60%	271.13
55%	295.04
50%	319.78
45%	348.86
40%	382.42
35%	419.40
30%	463.96
25%	516.86
20%	585.61
15%	677.52
10%	813.76
5%	1,070.51
0%	1,999.84

End of Forecast

Assessment Unit BANG0103
High-Amplitude Faulted Anticlines
Monte Carlo Results

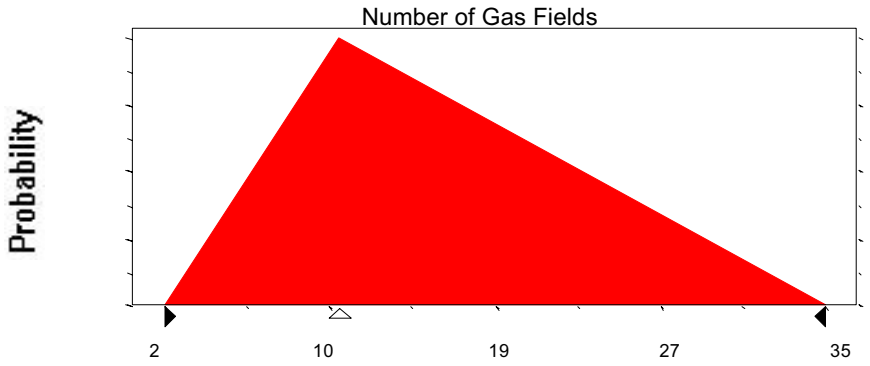
Assumptions

Assumption: Number of Gas Fields

Triangular distribution with parameters:

Minimum	2
Likeliest	11
Maximum	35

Selected range is from 2 to 35
Mean value in simulation was 16



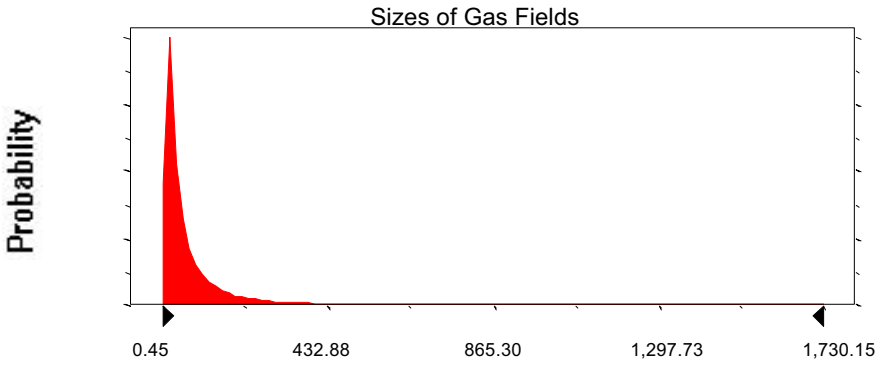
Assumption: Sizes of Gas Fields

Lognormal distribution with parameters:		Shifted parameters
Mean	72.02	114.02
Standard Deviation	170.67	170.67

Selected range is from 0.00 to 1,958.00	42.00 to 2,000.00
Mean value in simulation was 68.23	110.23

Assessment Unit BANG0103
High-Amplitude Faulted Anticlines
Monte Carlo Results

Assumption: Sizes of Gas Fields (cont'd)

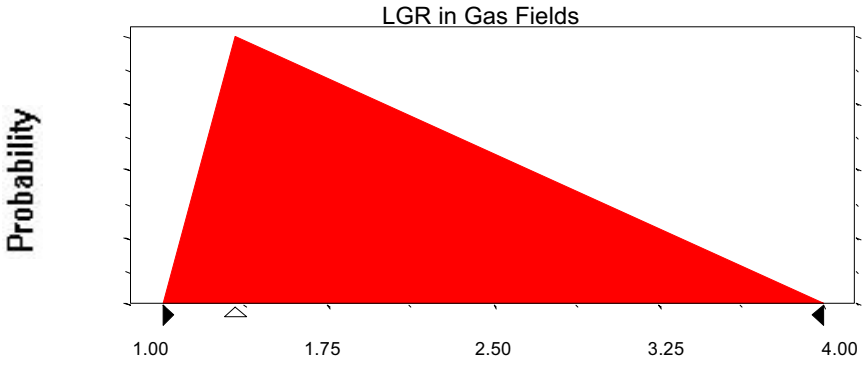


Assumption: LGR in Gas Fields

Triangular distribution with parameters:

Minimum	1.00
Likeliest	1.33
Maximum	4.00

Selected range is from 1.00 to 4.00
Mean value in simulation was 2.11



End of Assumptions

Simulation started on 1/26/01 at 13:52:22
Simulation stopped on 1/26/01 at 14:08:35

Assessment Unit Bang0104
Moderately Folded Anticlines
Monte Carlo Results

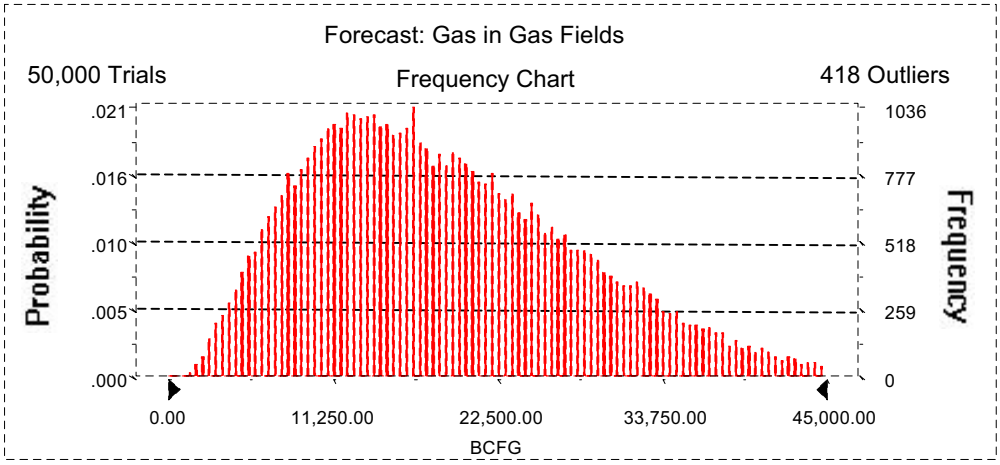
Assessment Unit BANG0104
Moderately Folded Anticlines
Monte Carlo Results

Forecast: Gas in Gas Fields

Summary:

Display range is from 0.00 to 45,000.00 BCFG
Entire range is from 1,255.51 to 63,464.29 BCFG
After 50,000 trials, the standard error of the mean is 41.76

Statistics:	Value
Trials	50000
Mean	19,009.71
Median	17,618.55
Mode	---
Standard Deviation	9,337.52
Variance	87,189,356.52
Skewness	0.66
Kurtosis	3.15
Coefficient of Variability	0.49
Range Minimum	1,255.51
Range Maximum	63,464.29
Range Width	62,208.78
Mean Standard Error	41.76



Assessment Unit BANG0104
Moderately Folded Anticlines
Monte Carlo Results

Forecast: Gas in Gas Fields (cont'd)

Percentiles:

Percentile	BCFG
100%	1,255.51
95%	6,104.18
90%	7,928.95
85%	9,400.52
80%	10,679.85
75%	11,871.99
70%	12,987.12
65%	14,114.07
60%	15,263.74
55%	16,460.96
50%	17,618.55
45%	18,946.60
40%	20,274.97
35%	21,723.27
30%	23,254.13
25%	24,992.24
20%	26,897.35
15%	29,171.50
10%	32,063.93
5%	36,213.79
0%	63,464.29

End of Forecast

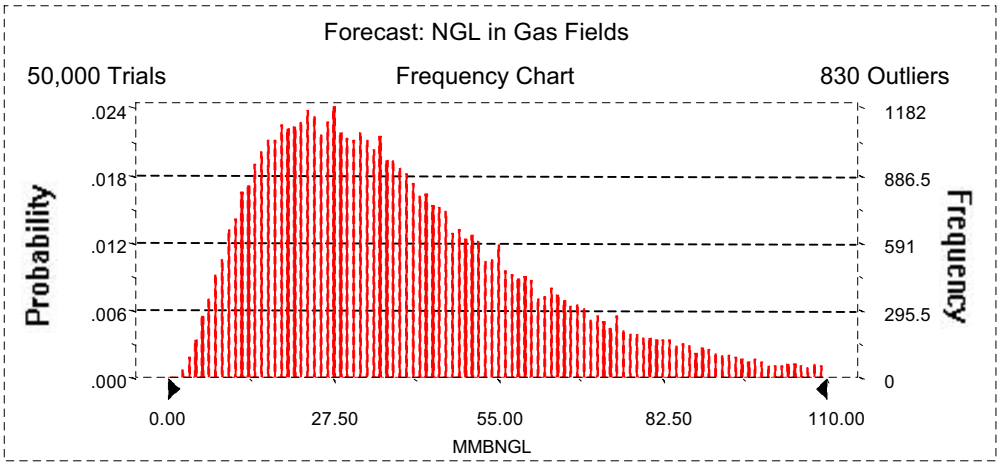
Assessment Unit BANG0104
Moderately Folded Anticlines
Monte Carlo Results

Forecast: NGL in Gas Fields

Summary:

Display range is from 0.00 to 110.00 MMBNGL
Entire range is from 1.58 to 221.24 MMBNGL
After 50,000 trials, the standard error of the mean is 0.11

Statistics:	Value
Trials	50000
Mean	40.10
Median	34.90
Mode	---
Standard Deviation	24.37
Variance	593.79
Skewness	1.30
Kurtosis	5.30
Coefficient of Variability	0.61
Range Minimum	1.58
Range Maximum	221.24
Range Width	219.66
Mean Standard Error	0.11



Assessment Unit BANG0104
Moderately Folded Anticlines
Monte Carlo Results

Forecast: NGL in Gas Fields (cont'd)

Percentiles:

Percentile	MMBNGL
100%	1.58
95%	10.89
90%	14.41
85%	17.23
80%	19.79
75%	22.27
70%	24.68
65%	27.21
60%	29.64
55%	32.28
50%	34.90
45%	37.69
40%	40.66
35%	44.02
30%	47.80
25%	52.17
20%	57.37
15%	64.18
10%	72.82
5%	87.31
0%	221.24

End of Forecast

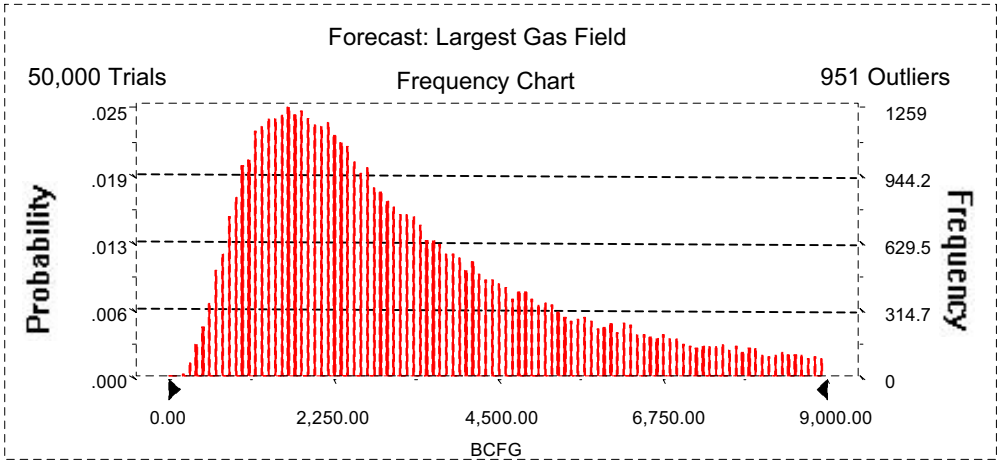
Assessment Unit BANG0104
Moderately Folded Anticlines
Monte Carlo Results

Forecast: Largest Gas Field

Summary:

Display range is from 0.00 to 9,000.00 BCFG
Entire range is from 164.41 to 9,998.27 BCFG
After 50,000 trials, the standard error of the mean is 9.30

Statistics:	Value
Trials	50000
Mean	3,251.36
Median	2,676.94
Mode	---
Standard Deviation	2,080.60
Variance	4,328,883.48
Skewness	1.12
Kurtosis	3.72
Coefficient of Variability	0.64
Range Minimum	164.41
Range Maximum	9,998.27
Range Width	9,833.86
Mean Standard Error	9.30



Assessment Unit BANG0104
Moderately Folded Anticlines
Monte Carlo Results

Forecast: Largest Gas Field (cont'd)

Percentiles:

Percentile	BCFG
100%	164.41
95%	884.32
90%	1,124.30
85%	1,324.58
80%	1,510.40
75%	1,694.27
70%	1,875.41
65%	2,061.57
60%	2,253.34
55%	2,454.85
50%	2,676.94
45%	2,921.37
40%	3,198.93
35%	3,500.60
30%	3,863.52
25%	4,285.15
20%	4,808.16
15%	5,463.40
10%	6,366.80
5%	7,737.20
0%	9,998.27

End of Forecast

Assessment Unit BANG0104
Moderately Folded Anticlines
Monte Carlo Results

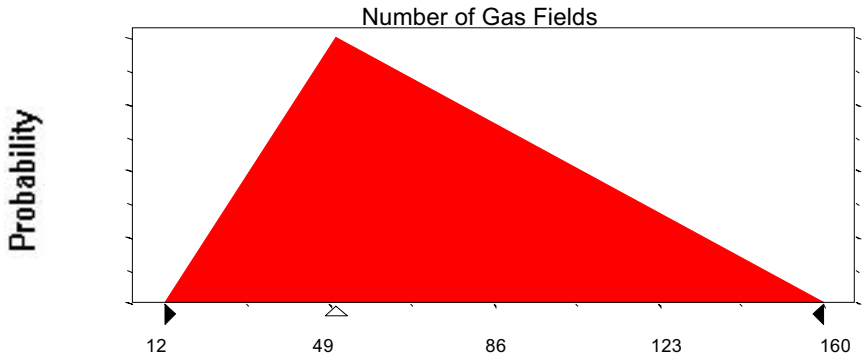
Assumptions

Assumption: Number of Gas Fields

Triangular distribution with parameters:

Minimum	12
Likeliest	51
Maximum	160

Selected range is from 12 to 160
Mean value in simulation was 74

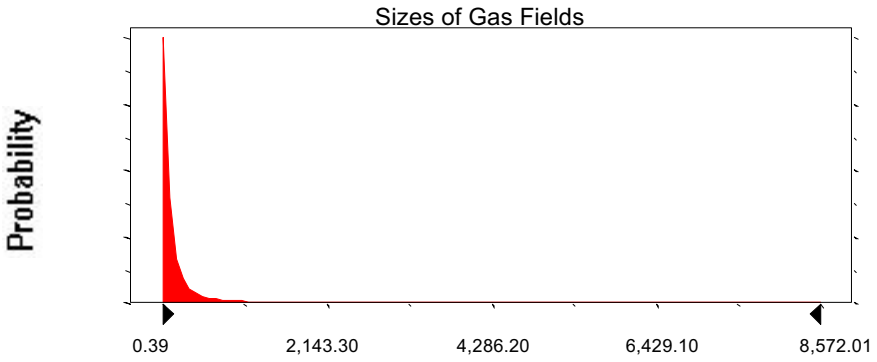


Assumption: Sizes of Gas Fields

Lognormal distribution with parameters:		Shifted parameters
Mean	232.06	274.06
Standard Deviation	899.03	899.03
Selected range is from	0.00 to 9,958.00	42.00 to 10,000.00
Mean value in simulation was	215.43	257.43

Assessment Unit BANG0104
Moderately Folded Anticlines
Monte Carlo Results

Assumption: Sizes of Gas Fields (cont'd)

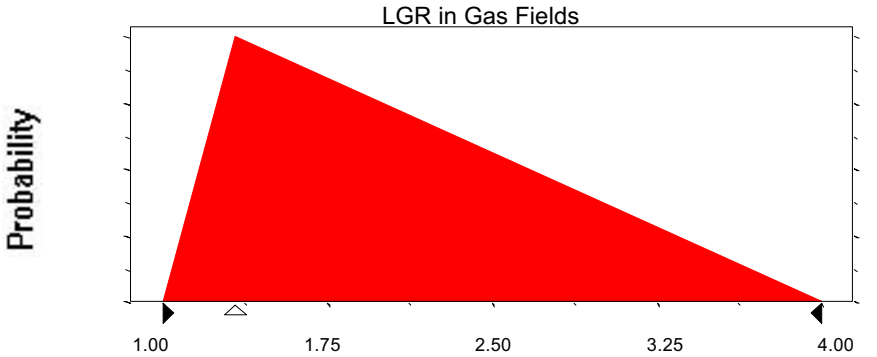


Assumption: LGR in Gas Fields

Triangular distribution with parameters:

Minimum	1.00
Likeliest	1.33
Maximum	4.00

Selected range is from 1.00 to 4.00
Mean value in simulation was 2.11



End of Assumptions

Simulation started on 1/25/01 at 20:59:56
Simulation stopped on 1/25/01 at 21:45:11

Assessment Unit Bang0105
Western Slope
Monte Carlo Results

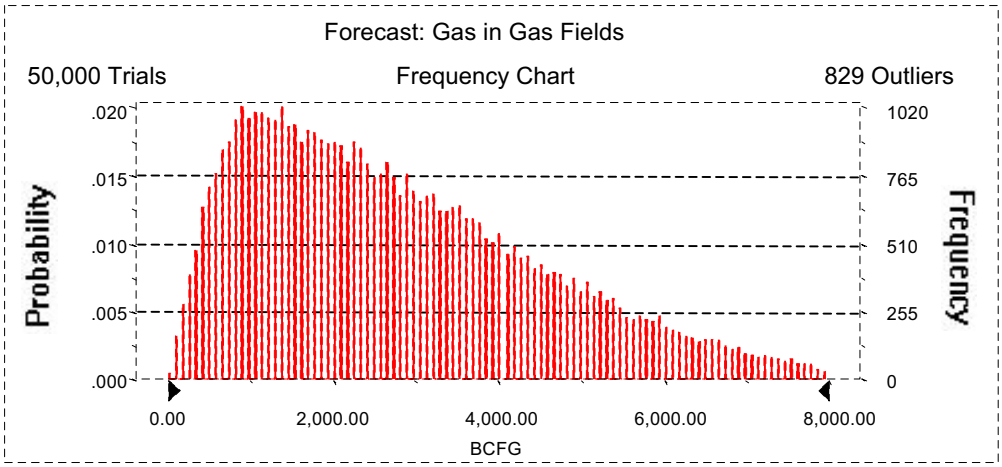
Assessment Unit BANG0105
Western Slope
Monte Carlo Results

Forecast: Gas in Gas Fields

Summary:

Display range is from 0.00 to 8,000.00 BCFG
Entire range is from 42.72 to 14,809.53 BCFG
After 50,000 trials, the standard error of the mean is 8.59

Statistics:	Value
Trials	50000
Mean	2,890.44
Median	2,503.91
Mode	---
Standard Deviation	1,920.48
Variance	3,688,262.62
Skewness	1.03
Kurtosis	4.15
Coefficient of Variability	0.66
Range Minimum	42.72
Range Maximum	14,809.53
Range Width	14,766.81
Mean Standard Error	8.59



Assessment Unit BANG0105
Western Slope
Monte Carlo Results

Forecast: Gas in Gas Fields (cont'd)

Percentiles:

Percentile	BCFG
100%	42.72
95%	533.84
90%	775.43
85%	979.63
80%	1,180.89
75%	1,386.03
70%	1,590.83
65%	1,809.46
60%	2,030.92
55%	2,263.45
50%	2,503.91
45%	2,757.79
40%	3,035.15
35%	3,331.41
30%	3,646.61
25%	4,004.01
20%	4,414.15
15%	4,911.18
10%	5,538.55
5%	6,536.74
0%	14,809.53

End of Forecast

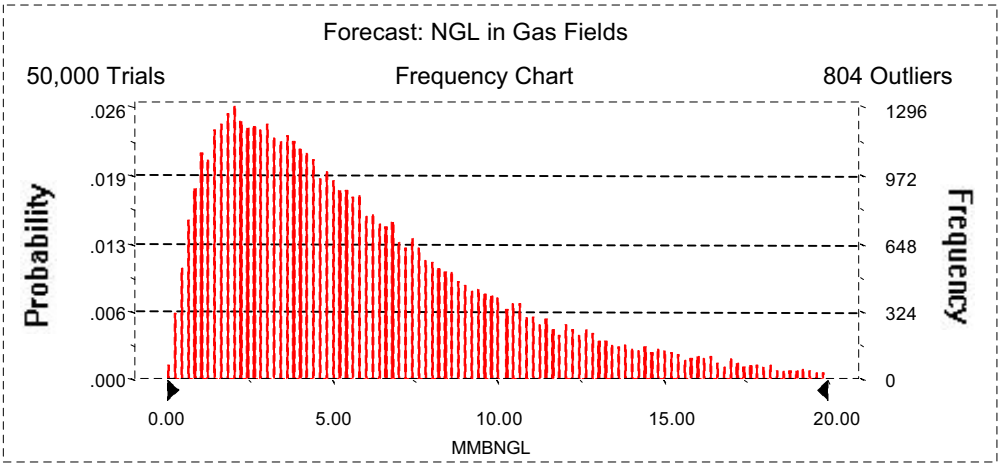
Assessment Unit BANG0105
Western Slope
Monte Carlo Results

Forecast: NGL in Gas Fields

Summary:

Display range is from 0.00 to 20.00 MMBNGL
Entire range is from 0.05 to 49.76 MMBNGL
After 50,000 trials, the standard error of the mean is 0.02

Statistics:	Value
Trials	50000
Mean	6.10
Median	4.92
Mode	---
Standard Deviation	4.67
Variance	21.85
Skewness	1.57
Kurtosis	6.59
Coefficient of Variability	0.77
Range Minimum	0.05
Range Maximum	49.76
Range Width	49.72
Mean Standard Error	0.02



Assessment Unit BANG0105
Western Slope
Monte Carlo Results

Forecast: NGL in Gas Fields (cont'd)

Percentiles:

Percentile	MMBNGL
100%	0.05
95%	0.98
90%	1.45
85%	1.86
80%	2.26
75%	2.67
70%	3.08
65%	3.51
60%	3.95
55%	4.42
50%	4.92
45%	5.45
40%	6.03
35%	6.69
30%	7.42
25%	8.25
20%	9.27
15%	10.55
10%	12.35
5%	15.29
0%	49.76

End of Forecast

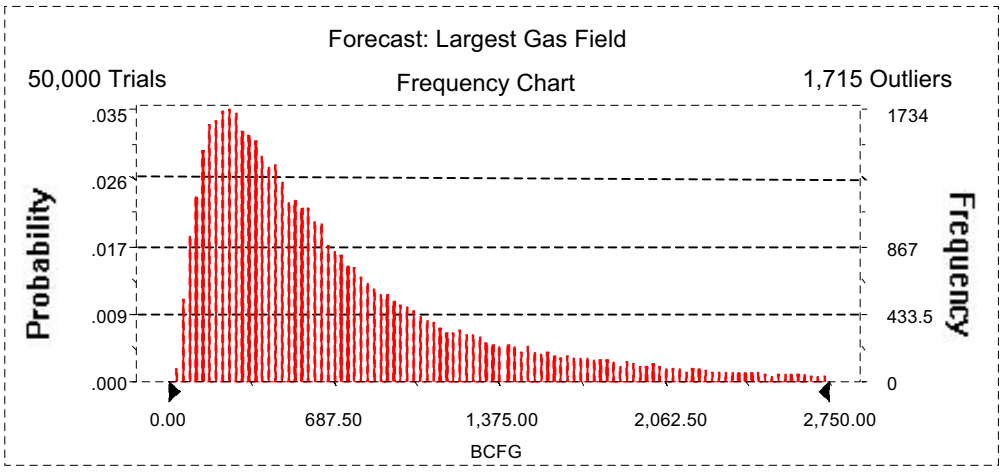
Assessment Unit BANG0105
Western Slope
Monte Carlo Results

Forecast: Largest Gas Field

Summary:

Display range is from 0.00 to 2,750.00 BCFG
Entire range is from 42.72 to 4,499.78 BCFG
After 50,000 trials, the standard error of the mean is 3.32

Statistics:	Value
Trials	50000
Mean	787.41
Median	545.06
Mode	---
Standard Deviation	742.22
Variance	550,884.28
Skewness	2.11
Kurtosis	8.10
Coefficient of Variability	0.94
Range Minimum	42.72
Range Maximum	4,499.78
Range Width	4,457.06
Mean Standard Error	3.32



Assessment Unit BANG0105
Western Slope
Monte Carlo Results

Forecast: Largest Gas Field (cont'd)

Percentiles:

Percentile	BCFG
100%	42.72
95%	132.46
90%	178.24
85%	219.58
80%	259.36
75%	299.20
70%	342.15
65%	386.61
60%	435.34
55%	486.37
50%	545.06
45%	606.95
40%	676.41
35%	760.01
30%	861.94
25%	986.27
20%	1,149.95
15%	1,378.53
10%	1,730.27
5%	2,377.11
0%	4,499.78

End of Forecast

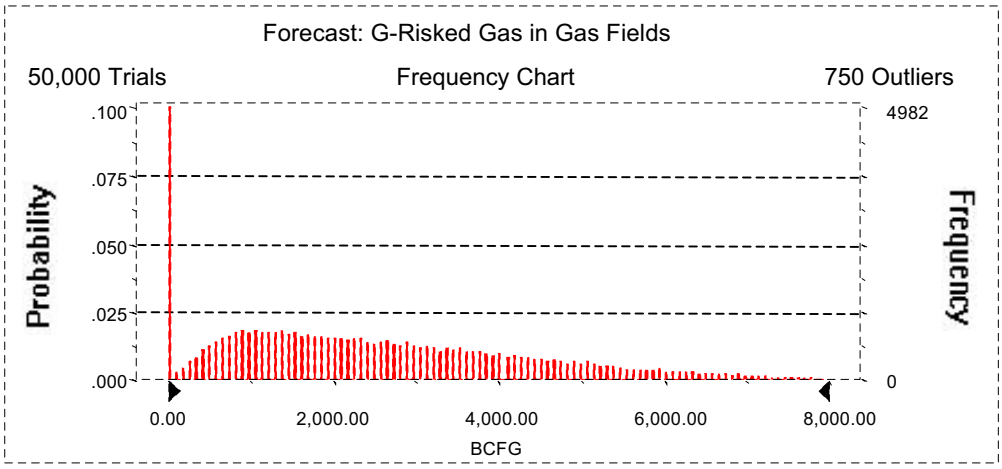
Assessment Unit BANG0105
Western Slope
Monte Carlo Results

Forecast: G-Risked Gas in Gas Fields

Summary:

Display range is from 0.00 to 8,000.00 BCFG
Entire range is from 0.00 to 14,809.53 BCFG
After 50,000 trials, the standard error of the mean is 9.03

Statistics:	Value
Trials	50000
Mean	2,606.15
Median	2,240.91
Mode	0.00
Standard Deviation	2,018.53
Variance	4,074,477.11
Skewness	0.94
Kurtosis	3.90
Coefficient of Variability	0.77
Range Minimum	0.00
Range Maximum	14,809.53
Range Width	14,809.53
Mean Standard Error	9.03



Assessment Unit BANG0105
Western Slope
Monte Carlo Results

Forecast: G-Risked Gas in Gas Fields (cont'd)

Percentiles:

Percentile	BCFG
100%	0.00
95%	0.00
90%	95.26
85%	573.45
80%	829.86
75%	1,052.48
70%	1,275.15
65%	1,499.52
60%	1,736.18
55%	1,985.63
50%	2,240.91
45%	2,508.04
40%	2,790.69
35%	3,105.11
30%	3,441.55
25%	3,800.07
20%	4,223.87
15%	4,746.71
10%	5,387.20
5%	6,401.89
0%	14,809.53

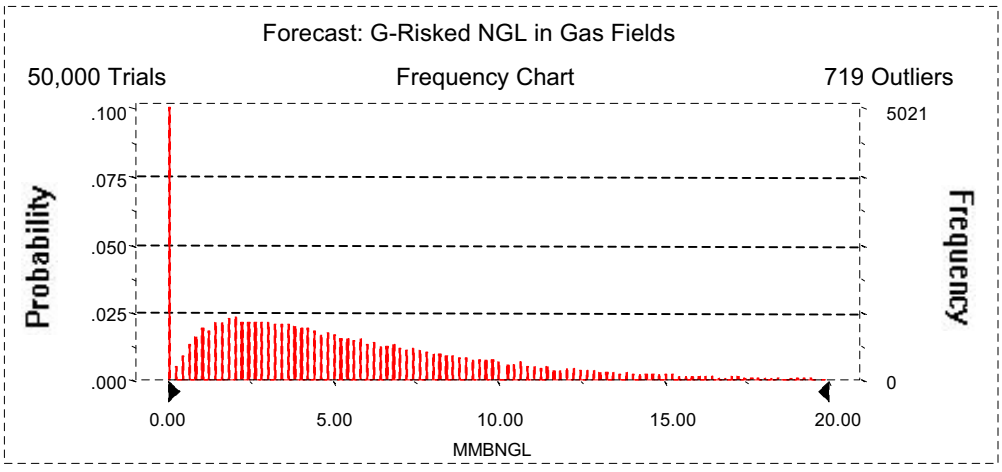
End of Forecast

Assessment Unit BANG0105
Western Slope
Monte Carlo Results

Forecast: G-Risked NGL in Gas Fields

Summary:
Display range is from 0.00 to 20.00 MMBNGL
Entire range is from 0.00 to 49.76 MMBNGL
After 50,000 trials, the standard error of the mean is 0.02

Statistics:	Value
Trials	50000
Mean	5.50
Median	4.36
Mode	0.00
Standard Deviation	4.80
Variance	23.01
Skewness	1.48
Kurtosis	6.27
Coefficient of Variability	0.87
Range Minimum	0.00
Range Maximum	49.76
Range Width	49.76
Mean Standard Error	0.02



Assessment Unit BANG0105
Western Slope
Monte Carlo Results

Forecast: G-Risked NGL in Gas Fields (cont'd)

Percentiles:

Percentile	MMBNGL
100%	0.00
95%	0.00
90%	0.17
85%	1.06
80%	1.56
75%	2.00
70%	2.45
65%	2.91
60%	3.37
55%	3.86
50%	4.36
45%	4.92
40%	5.52
35%	6.18
30%	6.93
25%	7.78
20%	8.80
15%	10.10
10%	11.90
5%	14.88
0%	49.76

End of Forecast

Assessment Unit BANG0105
Western Slope
Monte Carlo Results

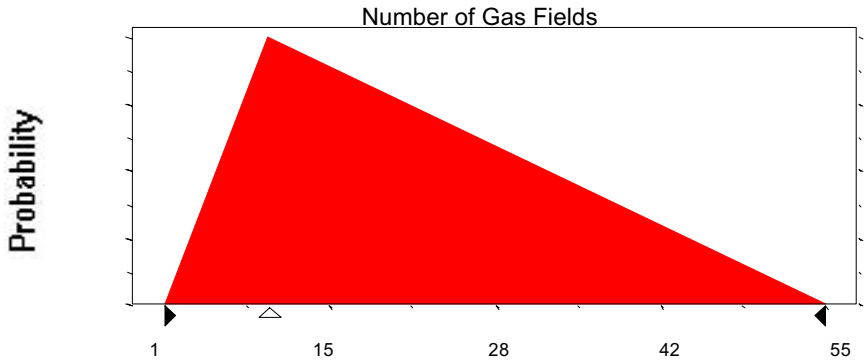
Assumptions

Assumption: Number of Gas Fields

Triangular distribution with parameters:

Minimum	1
Likeliest	10
Maximum	55

Selected range is from 1 to 55
Mean value in simulation was 22



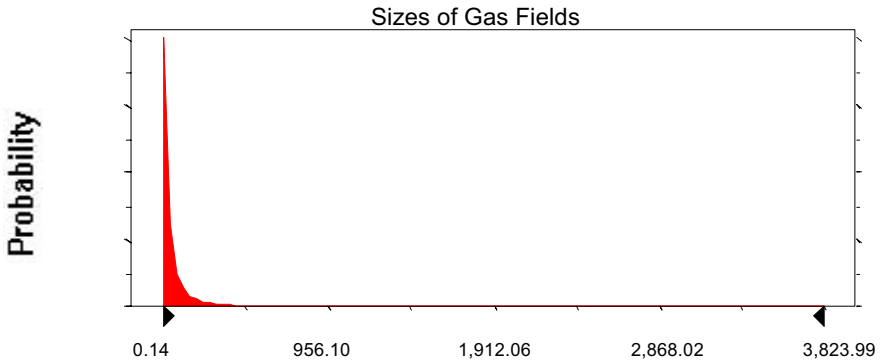
Assumption: Sizes of Gas Fields

Lognormal distribution with parameters:		Shifted parameters
Mean	98.32	140.32
Standard Deviation	408.60	408.60

Selected range is from 0.00 to 4,458.00	42.00 to 4,500.00
Mean value in simulation was 91.60	133.60

Assessment Unit BANG0105
Western Slope
Monte Carlo Results

Assumption: Sizes of Gas Fields (cont'd)

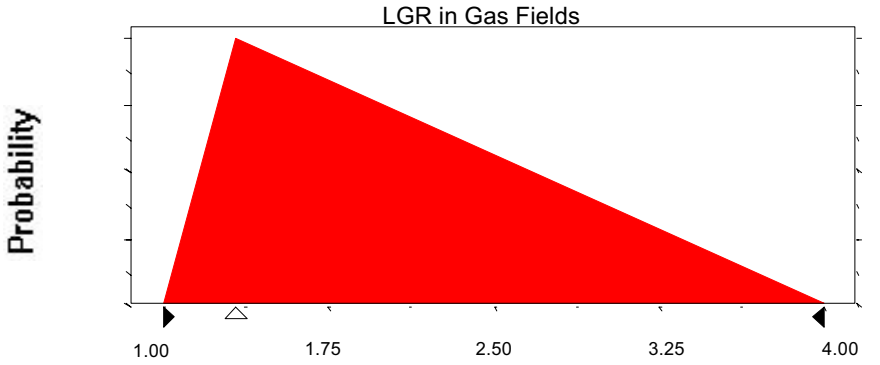


Assumption: LGR in Gas Fields

Triangular distribution with parameters:

Minimum	1.00
Likeliest	1.33
Maximum	4.00

Selected range is from 1.00 to 4.00
Mean value in simulation was 2.11



End of Assumptions

Simulation started on 1/26/01 at 14:12:56
Simulation stopped on 1/26/01 at 14:33:23

Assessment Unit Bang0106
Western Platform
Monte Carlo Results

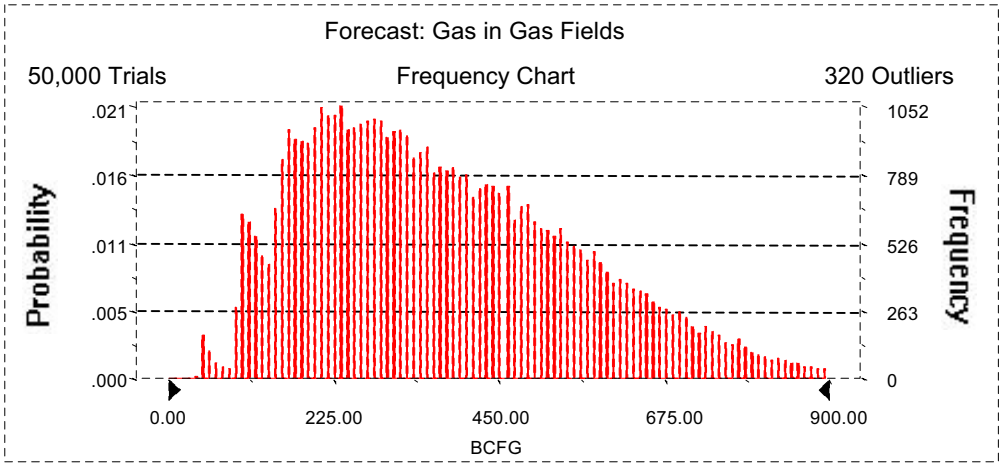
Assessment Unit BANG0106
Western Platform
Monte Carlo Results

Forecast: Gas in Gas Fields

Summary:

Display range is from 0.00 to 900.00 BCFG
Entire range is from 43.32 to 1,346.56 BCFG
After 50,000 trials, the standard error of the mean is 0.83

Statistics:	Value
Trials	50000
Mean	377.61
Median	348.25
Mode	---
Standard Deviation	184.56
Variance	34,063.62
Skewness	0.66
Kurtosis	3.05
Coefficient of Variability	0.49
Range Minimum	43.32
Range Maximum	1,346.56
Range Width	1,303.24
Mean Standard Error	0.83



Assessment Unit BANG0106
Western Platform
Monte Carlo Results

Forecast: Gas in Gas Fields (cont'd)

Percentiles:

Percentile	BCFG
100%	43.32
95%	125.55
90%	162.36
85%	186.28
80%	210.08
75%	231.98
70%	254.13
65%	276.96
60%	299.76
55%	323.14
50%	348.25
45%	374.94
40%	403.12
35%	433.49
30%	464.13
25%	498.63
20%	537.44
15%	581.77
10%	637.78
5%	718.29
0%	1,346.56

End of Forecast

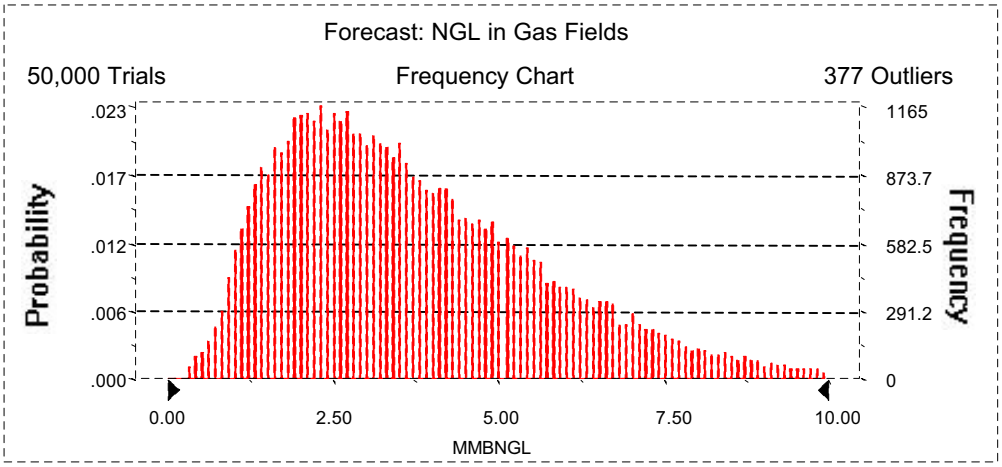
Assessment Unit BANG0106
Western Platform
Monte Carlo Results

Forecast: NGL in Gas Fields

Summary:

Display range is from 0.00 to 10.00 MMBNGL
Entire range is from 0.27 to 15.99 MMBNGL
After 50,000 trials, the standard error of the mean is 0.01

Statistics:	Value
Trials	50000
Mean	3.77
Median	3.39
Mode	---
Standard Deviation	2.03
Variance	4.11
Skewness	0.93
Kurtosis	3.81
Coefficient of Variability	0.54
Range Minimum	0.27
Range Maximum	15.99
Range Width	15.72
Mean Standard Error	0.01



Assessment Unit BANG0106
Western Platform
Monte Carlo Results

Forecast: NGL in Gas Fields (cont'd)

Percentiles:

Percentile	MMBNGL
100%	0.27
95%	1.19
90%	1.49
85%	1.76
80%	2.00
75%	2.22
70%	2.44
65%	2.67
60%	2.89
55%	3.14
50%	3.39
45%	3.65
40%	3.93
35%	4.24
30%	4.59
25%	4.97
20%	5.39
15%	5.91
10%	6.60
5%	7.63
0%	15.99

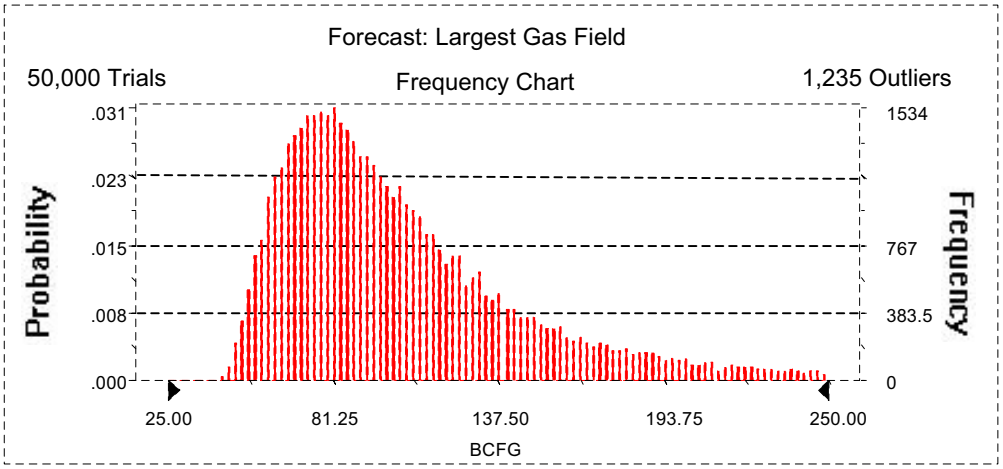
End of Forecast

Assessment Unit BANG0106
Western Platform
Monte Carlo Results

Forecast: Largest Gas Field

Summary:
Display range is from 25.00 to 250.00 BCFG
Entire range is from 43.32 to 399.05 BCFG
After 50,000 trials, the standard error of the mean is 0.22

Statistics:	Value
Trials	50000
Mean	109.23
Median	95.63
Mode	---
Standard Deviation	50.14
Variance	2,514.38
Skewness	1.96
Kurtosis	8.14
Coefficient of Variability	0.46
Range Minimum	43.32
Range Maximum	399.05
Range Width	355.73
Mean Standard Error	0.22



Assessment Unit BANG0106
Western Platform
Monte Carlo Results

Forecast: Largest Gas Field (cont'd)

Percentiles:

Percentile	BCFG
100%	43.32
95%	58.14
90%	63.45
85%	67.85
80%	71.87
75%	75.60
70%	79.40
65%	83.11
60%	86.95
55%	91.13
50%	95.63
45%	100.56
40%	105.77
35%	111.59
30%	118.43
25%	126.42
20%	136.70
15%	150.65
10%	171.89
5%	209.80
0%	399.05

End of Forecast

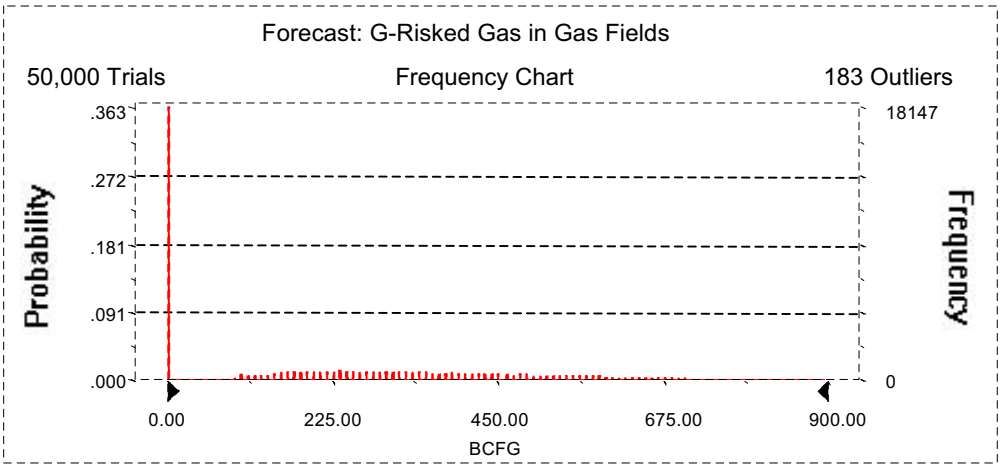
Assessment Unit BANG0106
Western Platform
Monte Carlo Results

Forecast: G-Risked Gas in Gas Fields

Summary:

Display range is from 0.00 to 900.00 BCFG
Entire range is from 0.00 to 1,331.72 BCFG
After 50,000 trials, the standard error of the mean is 1.04

Statistics:	Value
Trials	50000
Mean	239.89
Median	215.16
Mode	0.00
Standard Deviation	233.28
Variance	54,418.36
Skewness	0.64
Kurtosis	2.52
Coefficient of Variability	0.97
Range Minimum	0.00
Range Maximum	1,331.72
Range Width	1,331.72
Mean Standard Error	1.04



Assessment Unit BANG0106
Western Platform
Monte Carlo Results

Forecast: G-Risked Gas in Gas Fields (cont'd)

Percentiles:

Percentile	BCFG
100%	0.00
95%	0.00
90%	0.00
85%	0.00
80%	0.00
75%	0.00
70%	0.00
65%	0.00
60%	131.85
55%	178.18
50%	215.16
45%	249.69
40%	285.90
35%	321.56
30%	362.66
25%	406.83
20%	454.24
15%	508.14
10%	575.26
5%	666.16
0%	1,331.72

End of Forecast

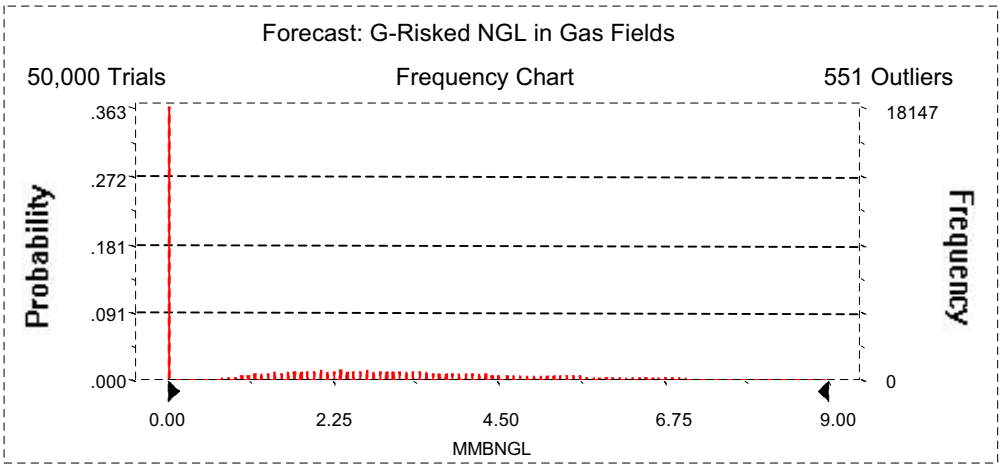
Assessment Unit BANG0106
Western Platform
Monte Carlo Results

Forecast: G-Risked NGL in Gas Fields

Summary:

Display range is from 0.00 to 9.00 MMBNGL
Entire range is from 0.00 to 14.47 MMBNGL
After 50,000 trials, the standard error of the mean is 0.01

Statistics:	Value
Trials	50000
Mean	2.40
Median	2.05
Mode	0.00
Standard Deviation	2.43
Variance	5.88
Skewness	0.85
Kurtosis	3.16
Coefficient of Variability	1.01
Range Minimum	0.00
Range Maximum	14.47
Range Width	14.47
Mean Standard Error	0.01



Assessment Unit BANG0106
Western Platform
Monte Carlo Results

Forecast: G-Risked NGL in Gas Fields (cont'd)

Percentiles:

Percentile	MMBNGL
100%	0.00
95%	0.00
90%	0.00
85%	0.00
80%	0.00
75%	0.00
70%	0.00
65%	0.00
60%	1.23
55%	1.68
50%	2.05
45%	2.40
40%	2.74
35%	3.13
30%	3.53
25%	3.97
20%	4.48
15%	5.09
10%	5.82
5%	6.97
0%	14.47

End of Forecast

Assessment Unit BANG0106
Western Platform
Monte Carlo Results

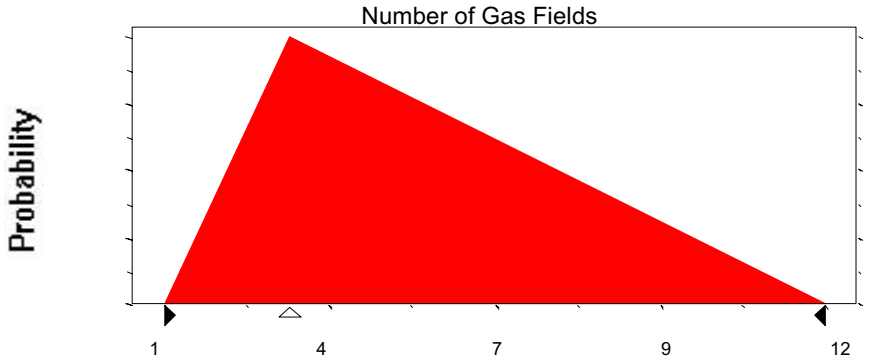
Assumptions

Assumption: Number of Gas Fields

Triangular distribution with parameters:

Minimum	1
Likeliest	3
Maximum	12

Selected range is from 1 to 12
Mean value in simulation was 5

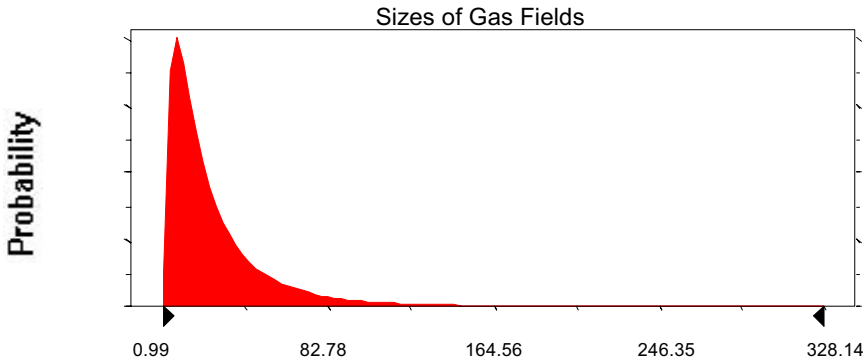


Assumption: Sizes of Gas Fields

Lognormal distribution with parameters:		Shifted parameters
Mean	28.75	70.75
Standard Deviation	35.80	35.80
Selected range is from	0.00 to 358.00	42.00 to 400.00
Mean value in simulation was	28.35	70.35

Assessment Unit BANG0106
Western Platform
Monte Carlo Results

Assumption: Sizes of Gas Fields (cont'd)

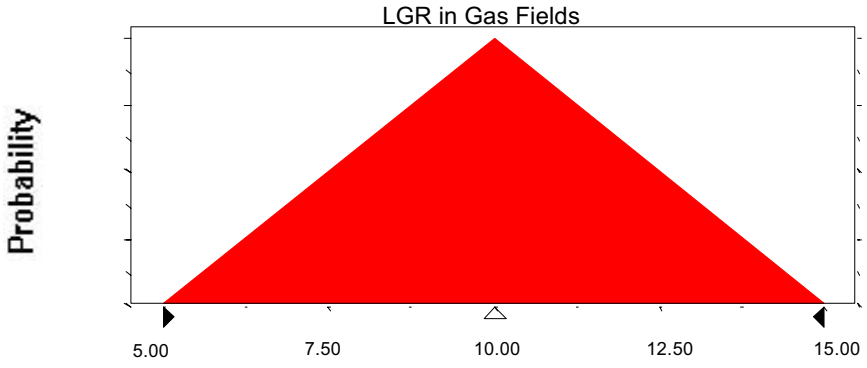


Assumption: LGR in Gas Fields

Triangular distribution with parameters:

Minimum	5.00
Likeliest	10.00
Maximum	15.00

Selected range is from 5.00 to 15.00
Mean value in simulation was 9.99



End of Assumptions

Simulation started on 1/26/01 at 14:37:16
Simulation stopped on 1/26/01 at 14:50:47

Addendum 2

Assessment Unit Bang0101
Surma Basin
Seventh Approximation Data Form

SEVENTH APPROXIMATION
DATA FORM FOR CONVENTIONAL ASSESSMENT UNITS (Version 2, 10-5-00)

IDENTIFICATION INFORMATION

Date:……..	1/23/2001		
Assessment Geologist:……..	Petrobangla/USGS		
Region:……..	South Asia	Number:	8
Province:……	Country of Bangladesh	Number:	
Priority or Boutique……	Special		
Total Petroleum System:……	Tertiary Composite	Number:	BANG01
Assessment Unit:……	Surma Basin	Number:	BANG0101
Based on Data as of:……..	December-00		
* Notes from Assessor	1/96 Petroconsultants and Proprietary Data from IOC. Special joint assessment sponsered by U.S.AID. No growth function used.		

CHARACTERISTICS OF ASSESSMENT UNIT

Oil (<20,000 cfg/bo overall) **or** Gas (≥20,000 cfg/bo overall):… Gas

What is the minimum field size?……. 7 mmboe grown
(the smallest field that has potential to be added to reserves in the next 30 years)

Number of discovered fields exceeding minimum size:…… Oil: 0 Gas: 9
Established (>13 fields) _____ Frontier (1-13 fields) X Hypothetical (no fields) _____

Median size (grown) of discovered oil fields (mmboe):
1st 3rd _____ 2nd 3rd _____ 3rd 3rd _____
Median size (grown) of discovered gas fields (bcfg):
1st 3rd 1309 2nd 3rd 513 3rd 3rd _____

Assessment-Unit Probabilities:

Attribute	Probability of occurrence (0-1.0)
1. **CHARGE:** Adequate petroleum charge for an undiscovered field ≥ minimum size……	1.0
2. **ROCKS:** Adequate reservoirs, traps, and seals for an undiscovered field ≥ minimum size……	1.0
3. **TIMING OF GEOLOGIC EVENTS:** Favorable timing for an undiscovered field ≥ minimum size	1.0
Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3):……..……..……	1.0
4. **ACCESSIBILITY:** Adequate location to allow exploration for an undiscovered field ≥ minimum size……..……..……..……	1.0

UNDISCOVERED FIELDS

Number of Undiscovered Fields: How many undiscovered fields exist that are ≥ minimum size?:
(uncertainty of fixed but unknown values)

Oil fields:……min. no. (>0)	_____	median no.	_____	max no.	_____
Gas fields:……min. no. (>0)	7	median no.	30	max no.	80

Size of Undiscovered Fields: What are the anticipated sizes (**grown**) of the above fields?:
(variations in the sizes of undiscovered fields)

Oil in oil fields (mmbo)……..……min. size	_____	median size	_____	max. size	_____
Gas in gas fields (bcfg):……min. size	42	median size	95	max. size	10000

Assessment Unit (name, no.)
Surma Basin, BANG0101

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS
(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……			
NGL/gas ratio (bngl/mmcfg)……			
Gas fields:	**minimum**	**median**	**maximum**
Liquids/gas ratio (bngl/mmcfg)……	5	10	15
Oil/gas ratio (bo/mmcfg)……			

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS
(variations in the properties of undiscovered fields)

Oil Fields:	minimum	median	maximum
API gravity (degrees)……			
Sulfur content of oil (%)……			
Drilling Depth (m) ……			
Depth (m) of water (if applicable)……			
Gas Fields:	**minimum**	**median**	**maximum**
Inert gas content (%)……	0.1	0.4	0.9
CO_2 content (%)……	0.1	0.4	1
Hydrogen-sulfide content (%)……	0	0	0
Drilling Depth (m)……	1500	3500	5500
Depth (m) of water (if applicable)……	0	0	0

Assessment Unit (name, no.)
Surma Basin, BANG0101

ALLOCATION OF UNDISCOVERED RESOURCES IN THE ASSESSMENT UNIT TO COUNTRIES OR OTHER LAND PARCELS (uncertainty of fixed but unknown values)

1. Bangladesh represents 100 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		100	
Portion of volume % that is offshore (0-100%)……		0	

2. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

3. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

4. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Assessment Unit Bang0102
Eastern Extremely Folded Belt
Seventh Approximation Data Form

SEVENTH APPROXIMATION
DATA FORM FOR CONVENTIONAL ASSESSMENT UNITS (Version 2, 10-5-00)

IDENTIFICATION INFORMATION

Date:……..	1/24/2001		
Assessment Geologist:……..	Petrobangla/USGS		
Region:……..	South Asia	Number:	8
Province:……	Country of Bangladesh	Number:	
Priority or Boutique.……	Special		
Total Petroleum System:……	Tertiary Composite	Number:	BANG01
Assessment Unit:……	Easternmost Extremely Folded Belt	Number:	BANG0102
Based on Data as of:…….	12/1/2000 Petroconsultants		
* Notes from Assessor	1/96 Petroconsultants and Proprietary Data from IOC. Special joint assessment sponsered by U.S.AID. No growth function used.		

CHARACTERISTICS OF ASSESSMENT UNIT

Oil (<20,000 cfg/bo overall) **or** Gas (≥20,000 cfg/bo overall):… Gas

What is the minimum field size?……. 7 mmboe grown
(the smallest field that has potential to be added to reserves in the next 30 years)

Number of discovered fields exceeding minimum size:……. Oil: _____ Gas: 0
Established (>13 fields) _____ Frontier (1-13 fields) _____ Hypothetical (no fields) X

Median size (grown) of discovered oil fields (mmboe):
1st 3rd _____ 2nd 3rd _____ 3rd 3rd _____
Median size (grown) of discovered gas fields (bcfg):
1st 3rd _____ 2nd 3rd _____ 3rd 3rd _____

Assessment-Unit Probabilities:

Attribute	Probability of occurrence (0-1.0)
1. **CHARGE:** Adequate petroleum charge for an undiscovered field ≥ minimum size……	1.0
2. **ROCKS:** Adequate reservoirs, traps, and seals for an undiscovered field ≥ minimum size……	0.7
3. **TIMING OF GEOLOGIC EVENTS:** Favorable timing for an undiscovered field ≥ minimum size	1.0

Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3):……..……...…. 0.7

4. **ACCESSIBILITY:** Adequate location to allow exploration for an undiscovered field ≥ minimum size……..……..……..…… 1.0

UNDISCOVERED FIELDS

Number of Undiscovered Fields: How many undiscovered fields exist that are ≥ minimum size?:
(uncertainty of fixed but unknown values)

Oil fields:……min. no. (>0)	_____	median no.	_____	max no.	_____
Gas fields:……min. no. (>0)	1	median no.	7	max no.	15

Size of Undiscovered Fields: What are the anticipated sizes (**grown**) of the above fields?:
(variations in the sizes of undiscovered fields)

Oil in oil fields (mmbo)……..……min. size	_____	median size	_____	max. size	_____
Gas in gas fields (bcfg):……min. size	42	median size	60	max. size	400

Assessment Unit (name, no.)
Easternmost Extremely Folded Belt, BANG0102

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS
(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……			
NGL/gas ratio (bngl/mmcfg)……			

Gas fields:	minimum	median	maximum
Liquids/gas ratio (bngl/mmcfg)……	0.5	1	2
Oil/gas ratio (bo/mmcfg)……			

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS
(variations in the properties of undiscovered fields)

Oil Fields:	minimum	median	maximum
API gravity (degrees)……			
Sulfur content of oil (%)……			
Drilling Depth (m) ……			
Depth (m) of water (if applicable)……			

Gas Fields:	minimum	median	maximum
Inert gas content (%)……	0.1	0.4	0.9
CO_2 content (%)……	0.1	0.4	1
Hydrogen-sulfide content (%)……	0	0	0
Drilling Depth (m)……	1500	3000	4500
Depth (m) of water (if applicable)……	0	0	0

Assessment Unit (name, no.)
Easternmost Extremely Folded Belt, BANG0102

ALLOCATION OF UNDISCOVERED RESOURCES IN THE ASSESSMENT UNIT TO COUNTRIES OR OTHER LAND PARCELS (uncertainty of fixed but unknown values)

1. Bangladesh represents 100 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		100	
Portion of volume % that is offshore (0-100%)……		0	

2. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

3. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

4. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Assessment Unit Bang0103
High-Amplitude Faulted Anticlines
Seventh Approximation Data Form

SEVENTH APPROXIMATION
DATA FORM FOR CONVENTIONAL ASSESSMENT UNITS (Version 2, 10-5-00)

IDENTIFICATION INFORMATION

Date:……..	1/24/2001		
Assessment Geologist:……..	Petrobangla/USGS		
Region:……..	South Asia	Number:	8
Province:……	Country of Bangladesh	Number:	
Priority or Boutique……	Special		
Total Petroleum System:……	Tertiary Composite	Number:	BANG01
Assessment Unit:……	High-Amplitude Faulted Anticlines	Number:	BANG0103
Based on Data as of:…….	12/1/2000 Petroconsultants		
* Notes from Assessor	1/96 Petroconsultants and Proprietary Data from IOC. Special joint assessment sponsered by U.S.AID. No growth function used.		

CHARACTERISTICS OF ASSESSMENT UNIT

Oil (<20,000 cfg/bo overall) **or** Gas (≥20,000 cfg/bo overall):… Gas

What is the minimum field size?……. 7 mmboe grown
(the smallest field that has potential to be added to reserves in the next 30 years)

Number of discovered fields exceeding minimum size:…… Oil: 0 Gas: 1
Established (>13 fields) _____ Frontier (1-13 fields) X Hypothetical (no fields) _____

Median size (grown) of discovered oil fields (mmboe):
1st 3rd _____ 2nd 3rd _____ 3rd 3rd _____

Median size (known) of discovered gas fields (bcfg):
1st 3rd 98 2nd 3rd _____ 3rd 3rd _____

Assessment-Unit Probabilities:

Attribute	Probability of occurrence (0-1.0)
1. **CHARGE:** Adequate petroleum charge for an undiscovered field ≥ minimum size……	1.0
2. **ROCKS:** Adequate reservoirs, traps, and seals for an undiscovered field ≥ minimum size……	1.0
3. **TIMING OF GEOLOGIC EVENTS:** Favorable timing for an undiscovered field ≥ minimum size	1.0

Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3):……..……...…. 1.0

4. **ACCESSIBILITY:** Adequate location to allow exploration for an undiscovered field ≥ minimum size……..……..……..…… 1.0

UNDISCOVERED FIELDS

Number of Undiscovered Fields: How many undiscovered fields exist that are ≥ minimum size?:
(uncertainty of fixed but unknown values)

Oil fields:……min. no. (>0)	_____	median no.	_____	max no.	_____
Gas fields:……min. no. (>0)	2	median no.	15	max no.	35

Size of Undiscovered Fields: What are the anticipated sizes (**grown**) of the above fields?:
(variations in the sizes of undiscovered fields)

Oil in oil fields (mmbo)……..……min. size	_____	median size	_____	max. size	_____
Gas in gas fields (bcfg):……min. size	42	median size	70	max. size	2000

Assessment Unit (name, no.)
High Amplitude Faulted Anticlines, BANG0103

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS
(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……			
NGL/gas ratio (bngl/mmcfg)……			
Gas fields:	**minimum**	**median**	**maximum**
Liquids/gas ratio (bngl/mmcfg)……	1	2	4
Oil/gas ratio (bo/mmcfg)……			

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS
(variations in the properties of undiscovered fields)

Oil Fields:	minimum	median	maximum
API gravity (degrees)……			
Sulfur content of oil (%)……			
Drilling Depth (m) ……			
Depth (m) of water (if applicable)……			
Gas Fields:	**minimum**	**median**	**maximum**
Inert gas content (%)……	0.1	0.4	0.9
CO_2 content (%)……	0.1	0.4	1
Hydrogen-sulfide content (%)……	0	0	0
Drilling Depth (m)……	1500	3000	4500
Depth (m) of water (if applicable)……	0	0	3

Assessment Unit (name, no.)
High Amplitude Faulted Anticlines, BANG0103

ALLOCATION OF UNDISCOVERED RESOURCES IN THE ASSESSMENT UNIT TO COUNTRIES OR OTHER LAND PARCELS (uncertainty of fixed but unknown values)

1. Bangladesh represents 100 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		100	
Portion of volume % that is offshore (0-100%)……		0	

2. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

3. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

4. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Assessment Unit Bang0104
Moderately Folded Anticlines
Seventh Approximation Data Form

DATA FORM FOR CONVENTIONAL ASSESSMENT UNITS (Version 2, 10-5-00)

IDENTIFICATION INFORMATION

Date:……..	1/25/2001		
Assessment Geologist:……..	Petrobangla/USGS		
Region:……..	South Asia	Number:	8
Province:……	Country of Bangladesh	Number:	
Priority or Boutique.……	Special		
Total Petroleum System:……	Tertiary Composite	Number:	BANG01
Assessment Unit:……	Moderately Folded Anticlines	Number:	BANG0104
Based on Data as of:…….	12/1/2000 Petroconsultants		
* Notes from Assessor	1/96 Petroconsultants and Proprietary Data from IOC. Special joint assessment sponsered by U.S. AID. No growth function used.		

CHARACTERISTICS OF ASSESSMENT UNIT

Oil (<20,000 cfg/bo overall) **or** Gas (>20,000 cfg/bo overall):… Gas

What is the minimum field size?……. 7 mmboe grown
(the smallest field that has potential to be added to reserves in the next 30 years)

Number of discovered fields exceeding minimum size:…… Oil: 0 Gas: 9
Established (>13 fields) _____ Frontier (1-13 fields) X Hypothetical (no fields) _____

Median size (grown) of discovered oil fields (mmboe):
1st 3rd _____ 2nd 3rd _____ 3rd 3rd _____

Median size (grown) of discovered gas fields (bcfg):
1st 3rd 468 2nd 3rd 237 3rd 3rd _____

Assessment-Unit Probabilities:

Attribute	Probability of occurrence (0-1.0)
1. **CHARGE:** Adequate petroleum charge for an undiscovered field > minimum size……	1.0
2. **ROCKS:** Adequate reservoirs, traps, and seals for an undiscovered field > minimum size……	1.0
3. **TIMING OF GEOLOGIC EVENTS:** Favorable timing for an undiscovered field > minimum size	1.0
Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3):……..……...….	1.0
4. **ACCESSIBILITY:** Adequate location to allow exploration for an undiscovered field > minimum size……..……..……..……	1.0

UNDISCOVERED FIELDS

Number of Undiscovered Fields: How many undiscovered fields exist that are > minimum size?:
(uncertainty of fixed but unknown values)

Oil fields:……min. no. (>0)	_____	median no.	_____	max no.	_____
Gas fields:……min. no. (>0)	12	median no.	70	max no.	160

Size of Undiscovered Fields: What are the anticipated sizes (**grown**) of the above fields?:
(variations in the sizes of undiscovered fields)

Oil in oil fields (mmbo)……..……min. size	_____	median size	_____	max. size	_____
Gas in gas fields (bcfg):……min. size	42	median size	100	max. size	10000

Assessment Unit (name, no.)
Moderately Folded Anticlines, BANG0104

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS
(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……			
NGL/gas ratio (bngl/mmcfg)……			

Gas fields:	minimum	median	maximum
Liquids/gas ratio (bngl/mmcfg)……	1	2	4
Oil/gas ratio (bo/mmcfg)……			

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS
(variations in the properties of undiscovered fields)

Oil Fields:	minimum	median	maximum
API gravity (degrees)……			
Sulfur content of oil (%)……			
Drilling Depth (m) ……			
Depth (m) of water (if applicable)……			

Gas Fields:	minimum	median	maximum
Inert gas content (%)……	0.1	0.4	0.9
CO_2 content (%)……	0.1	0.4	1
Hydrogen-sulfide content (%)……	0	0	0
Drilling Depth (m)……	2500	3500	5000
Depth (m) of water (if applicable)……	0	20	200

Assessment Unit (name, no.)
Moderately Folded Anticlines, BANG0104

ALLOCATION OF UNDISCOVERED RESOURCES IN THE ASSESSMENT UNIT TO COUNTRIES OR OTHER LAND PARCELS (uncertainty of fixed but unknown values)

1. Bangladesh represents 100 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		100	
Portion of volume % that is offshore (0-100%)……		40	

2. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

3. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

4. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Assessment Unit Bang0105
Western Slope
Seventh Approximation Data Form

Seventh Approximation
DATA FORM FOR CONVENTIONAL ASSESSMENT UNITS (Version 2, 10-5-00)

IDENTIFICATION INFORMATION

Date:……..	1/25/2001		
Assessment Geologist:……..	Petrobangla/USGS		
Region:……..	South Asia	Number:	8
Province:……	Country of Bangladesh	Number:	
Priority or Boutique……	Special		
Total Petroleum System:……	Tertiary Composite	Number:	BANG01
Assessment Unit:……	Western Slope	Number:	BANG0105
Based on Data as of:…….	12/1/2000 Petrobangla		
* Notes from Assessor	1/96 Petroconsultants and Proprietary Data from IOC. Special joint assessment sponsered by U.S. AID. No growth function used.		

CHARACTERISTICS OF ASSESSMENT UNIT

Oil (<20,000 cfg/bo overall) **or** Gas (≥20,000 cfg/bo overall):… Gas

What is the minimum field size?……. 7 mmboe grown
(the smallest field that has potential to be added to reserves in the next 30 years)

Number of discovered fields exceeding minimum size:…… Oil: _____ Gas: 0
Established (>13 fields) _____ Frontier (1-13 fields) _____ Hypothetical (no fields) X

Median size (grown) of discovered oil fields (mmboe):
1st 3rd _____ 2nd 3rd _____ 3rd 3rd _____
Median size (grown) of discovered gas fields (bcfg):
1st 3rd _____ 2nd 3rd _____ 3rd 3rd _____

Assessment-Unit Probabilities:

Attribute	Probability of occurrence (0-1.0)
1. **CHARGE:** Adequate petroleum charge for an undiscovered field ≥ minimum size……	1.0
2. **ROCKS:** Adequate reservoirs, traps, and seals for an undiscovered field ≥ minimum size……	0.9
3. **TIMING OF GEOLOGIC EVENTS:** Favorable timing for an undiscovered field ≥ minimum size	1.0

Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3):……..……....…. 0.9

4. **ACCESSIBILITY:** Adequate location to allow exploration for an undiscovered field ≥ minimum size……..……..……..…… 1.0

UNDISCOVERED FIELDS

Number of Undiscovered Fields: How many undiscovered fields exist that are ≥ minimum size?:
(uncertainty of fixed but unknown values)

Oil fields:……min. no. (>0)	_____	median no. _____	max no. _____
Gas fields:……min. no. (>0)	1	20	55

Size of Undiscovered Fields: What are the anticipated sizes (**grown**) of the above fields?:
(variations in the sizes of undiscovered fields)

Oil in oil fields (mmbo)……..……min. size	_____	median size _____	max. size _____
Gas in gas fields (bcfg):……min. size	42	median size 65	max. size 4500

Assessment Unit (name, no.)
Western Slope, BANG0105

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS
(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……			
NGL/gas ratio (bngl/mmcfg)……			
Gas fields:	**minimum**	**median**	**maximum**
Liquids/gas ratio (bngl/mmcfg)……	1	2	4
Oil/gas ratio (bo/mmcfg)……			

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS
(variations in the properties of undiscovered fields)

Oil Fields:	minimum	median	maximum
API gravity (degrees)……			
Sulfur content of oil (%)……			
Drilling Depth (m) ……			
Depth (m) of water (if applicable)……			
Gas Fields:	**minimum**	**median**	**maximum**
Inert gas content (%)……	0.1	0.4	0.9
CO_2 content (%)……	0.1	0.4	1
Hydrogen-sulfide content (%)……	0	0	0
Drilling Depth (m)……	2500	3500	5000
Depth (m) of water (if applicable)……	0	20	200

Assessment Unit (name, no.)
Western Slope, BANG0105

ALLOCATION OF UNDISCOVERED RESOURCES IN THE ASSESSMENT UNIT TO COUNTRIES OR OTHER LAND PARCELS (uncertainty of fixed but unknown values)

1. Bangladesh represents 100 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		100	
Portion of volume % that is offshore (0-100%)……		45	

2. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

3. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

4. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Assessment Unit Bang0106
Western Platform
Seventh Approximation Data Form

SEVENTH APPROXIMATION
DATA FORM FOR CONVENTIONAL ASSESSMENT UNITS (Version 2, 10-5-00)

IDENTIFICATION INFORMATION

Date:……..	1/26/2001		
Assessment Geologist:……..	Petrobangla/USGS		
Region:……..	South Asia	Number:	8
Province:……	Country of Bangladesh	Number:	
Priority or Boutique.……	Special		
Total Petroleum System:……	Tertiary Composite	Number:	BANG01
Assessment Unit:……	Western Platform	Number:	BANG0106
Based on Data as of:…….	12/1/2000 Petrobangla		
* Notes from Assessor	1/96 Petroconsultants and Proprietary Data from IOC. Special joint assessment sponsered by U.S. AID. No growth function used.		

CHARACTERISTICS OF ASSESSMENT UNIT

Oil (<20,000 cfg/bo overall) **or** Gas (≥20,000 cfg/bo overall):… Gas

What is the minimum field size?……. 7 mmboe grown
(the smallest field that has potential to be added to reserves in the next 30 years)

Number of discovered fields exceeding minimum size:…… Oil: _____ Gas: 0
Established (>13 fields) _____ Frontier (1-13 fields) _____ Hypothetical (no fields) X

Median size (grown) of discovered oil fields (mmboe):
1st 3rd _____ 2nd 3rd _____ 3rd 3rd _____
Median size (grown) of discovered gas fields (bcfg):
1st 3rd _____ 2nd 3rd _____ 3rd 3rd _____

Assessment-Unit Probabilities:

Attribute	Probability of occurrence (0-1.0)
1. **CHARGE:** Adequate petroleum charge for an undiscovered field ≥ minimum size……	0.8
2. **ROCKS:** Adequate reservoirs, traps, and seals for an undiscovered field ≥ minimum size……	0.8
3. **TIMING OF GEOLOGIC EVENTS:** Favorable timing for an undiscovered field ≥ minimum size	1.0

Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3):……..……...…. 0.64

4. **ACCESSIBILITY:** Adequate location to allow exploration for an undiscovered field ≥ minimum size……..……..……..…… 1.0

UNDISCOVERED FIELDS

Number of Undiscovered Fields: How many undiscovered fields exist that are ≥ minimum size?:
(uncertainty of fixed but unknown values)

Oil fields:……min. no. (>0)	_____	median no.	_____	max no.	_____
Gas fields:……min. no. (>0)	1	median no.	5	max no.	12

Size of Undiscovered Fields: What are the anticipated sizes (**grown**) of the above fields?:
(variations in the sizes of undiscovered fields)

Oil in oil fields (mmbo)……..……min. size	_____	median size	_____	max. size	_____
Gas in gas fields (bcfg):……min. size	42	median size	60	max. size	400

Assessment Unit (name, no.)
Western Platform, BANG0106

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS
(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……			
NGL/gas ratio (bngl/mmcfg)……			
Gas fields:	**minimum**	**median**	**maximum**
Liquids/gas ratio (bngl/mmcfg)……	5	10	15
Oil/gas ratio (bo/mmcfg)……			

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS
(variations in the properties of undiscovered fields)

Oil Fields:	minimum	median	maximum
API gravity (degrees)……			
Sulfur content of oil (%)……			
Drilling Depth (m) ……			
Depth (m) of water (if applicable)……			
Gas Fields:	**minimum**	**median**	**maximum**
Inert gas content (%)……	0.1	0.4	0.9
CO_2 content (%)……	0.1	0.4	1
Hydrogen-sulfide content (%)……	0	0	0
Drilling Depth (m)……	2000	3500	4500
Depth (m) of water (if applicable)……	0	0	0

Assessment Unit (name, no.)
Western Platform, BANG0106

ALLOCATION OF UNDISCOVERED RESOURCES IN THE ASSESSMENT UNIT TO COUNTRIES OR OTHER LAND PARCELS (uncertainty of fixed but unknown values)

1. Bangladesh represents 100 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		100	
Portion of volume % that is offshore (0-100%)……		0	

2. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

3. _____ represents _____ areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

4. _____ represents _____ areal % of the total assessment unit

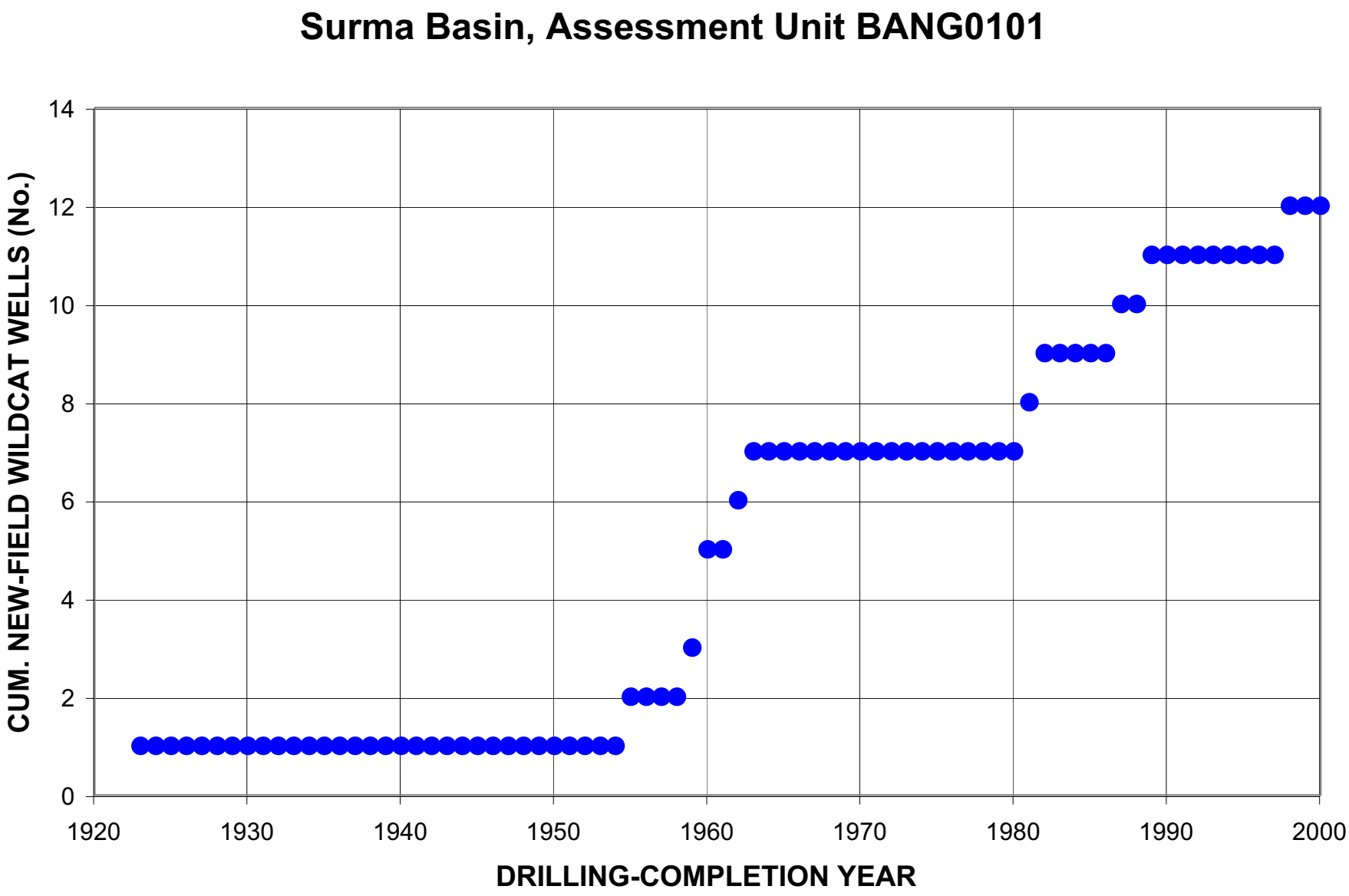
Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

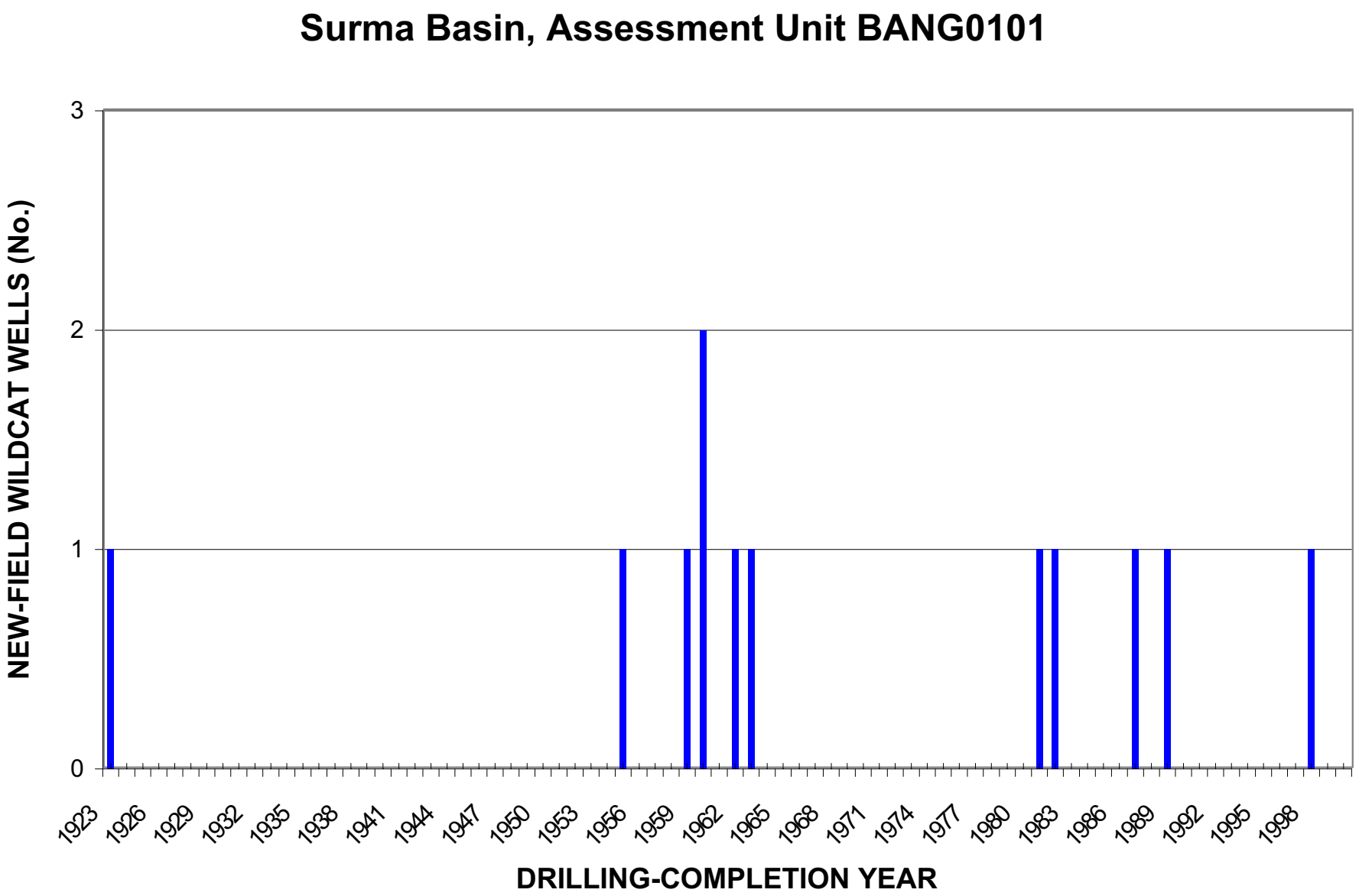
Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…			
Portion of volume % that is offshore (0-100%)……			

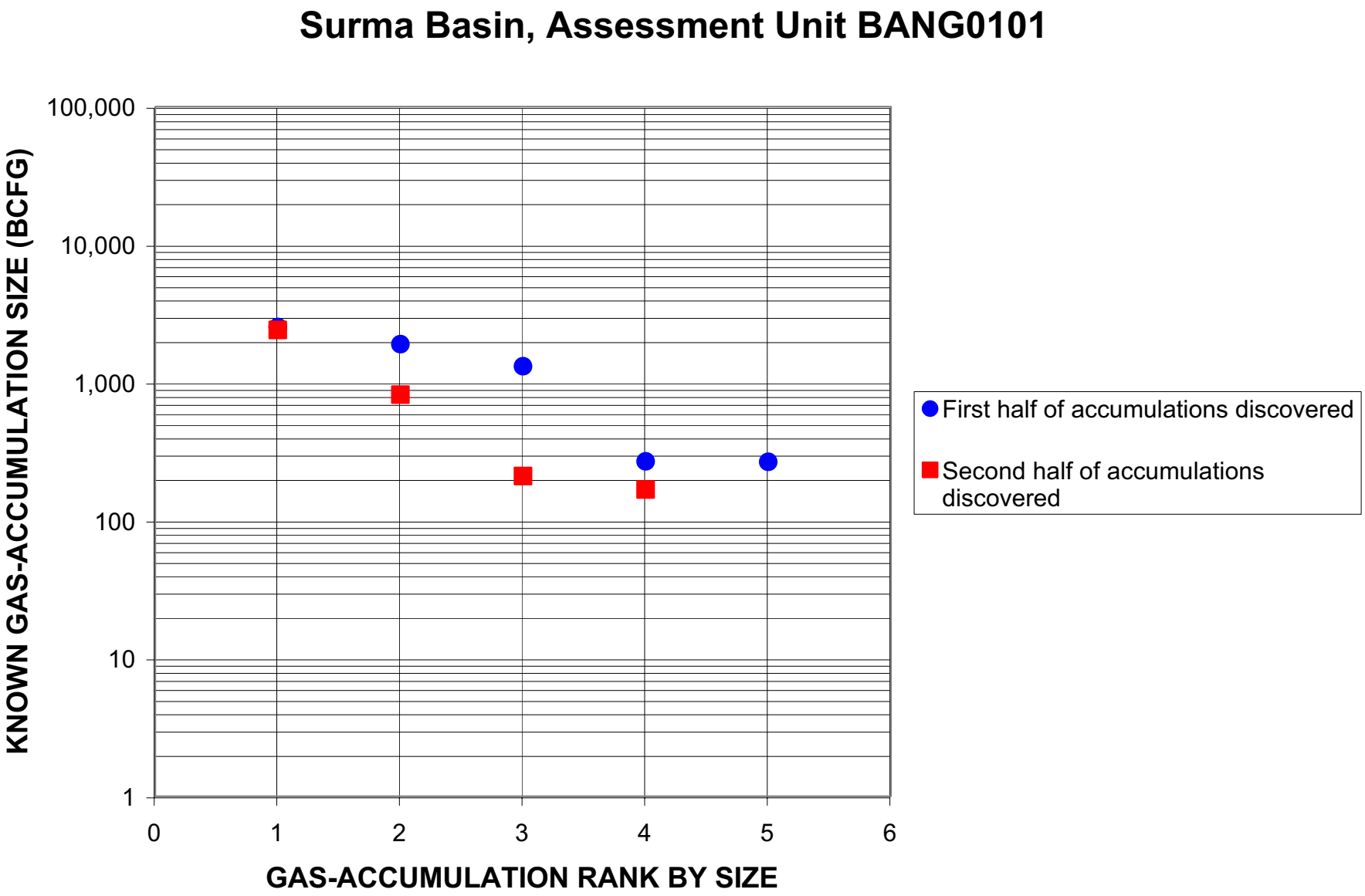
Assessment Unit Bang0101
Surma Basin
Known Data

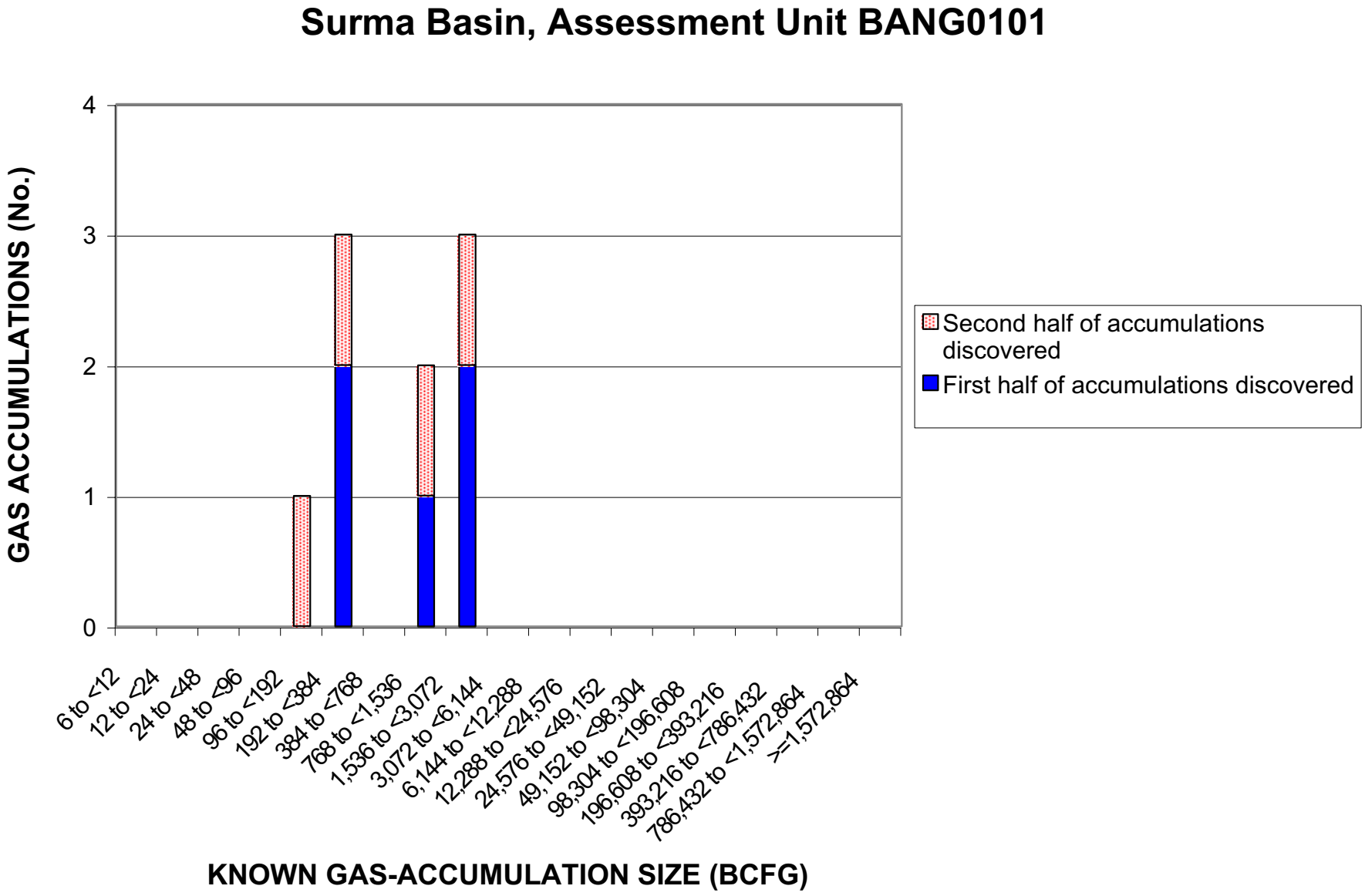
Surma Basin, Assessment Unit BANG0101
Known Data

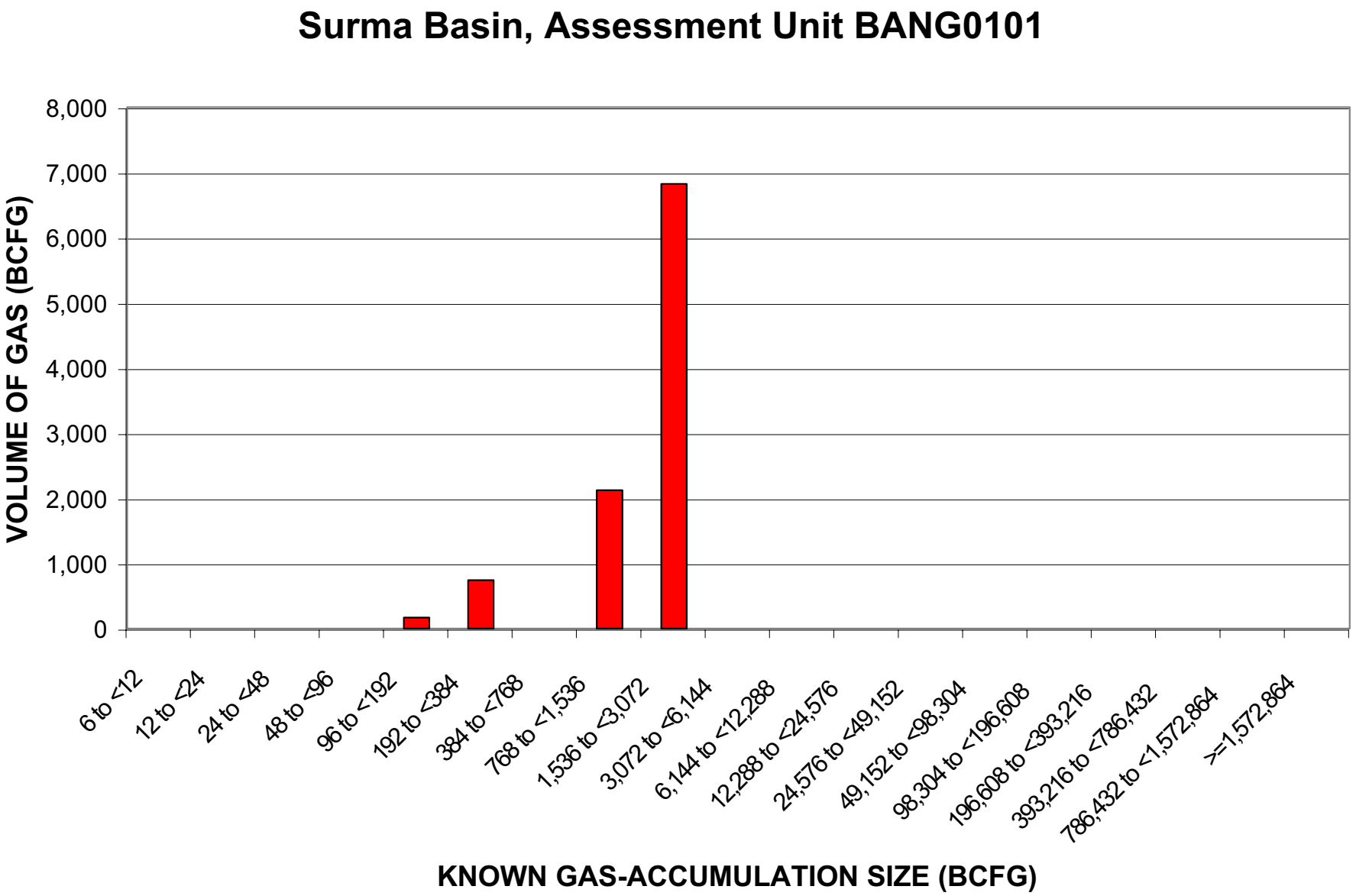
First half of accumulations discovered		*Second half of accumulations discovered*		*Total Gas (BCFG)*	
Mean	1253.4	Mean	898	Mean	1095.444444
Standard Error	446.5349482	Standard Error	522.0630549	Standard Error	323.5899802
Median	1309	Median	512.5	Median	815
Mode	#N/A	Mode	#N/A	Mode	#N/A
Standard Deviation	998.4824986	Standard Deviation	1044.12611	Standard Deviation	970.7699407
Sample Variance	996967.3	Sample Variance	1090199.333	Sample Variance	942394.2778
Kurtosis	-2.075983648	Kurtosis	2.203364998	Kurtosis	-1.604702621
Skewness	0.175956331	Skewness	1.564704407	Skewness	0.532885923
Range	2263	Range	2233	Range	2362
Minimum	266	Minimum	167	Minimum	167
Maximum	2529	Maximum	2400	Maximum	2529
Sum	6267	Sum	3592	Sum	9859
Count	5	Count	4	Count	9
Number of Years	8	Number of Years	35	Number of Years	43
First Year of First Half or First Third	Last Year of First Half or First Third	First Year of Second Half or Second Third	Last Year of Second Half or Second Third		
1955	1963	1981	1998		

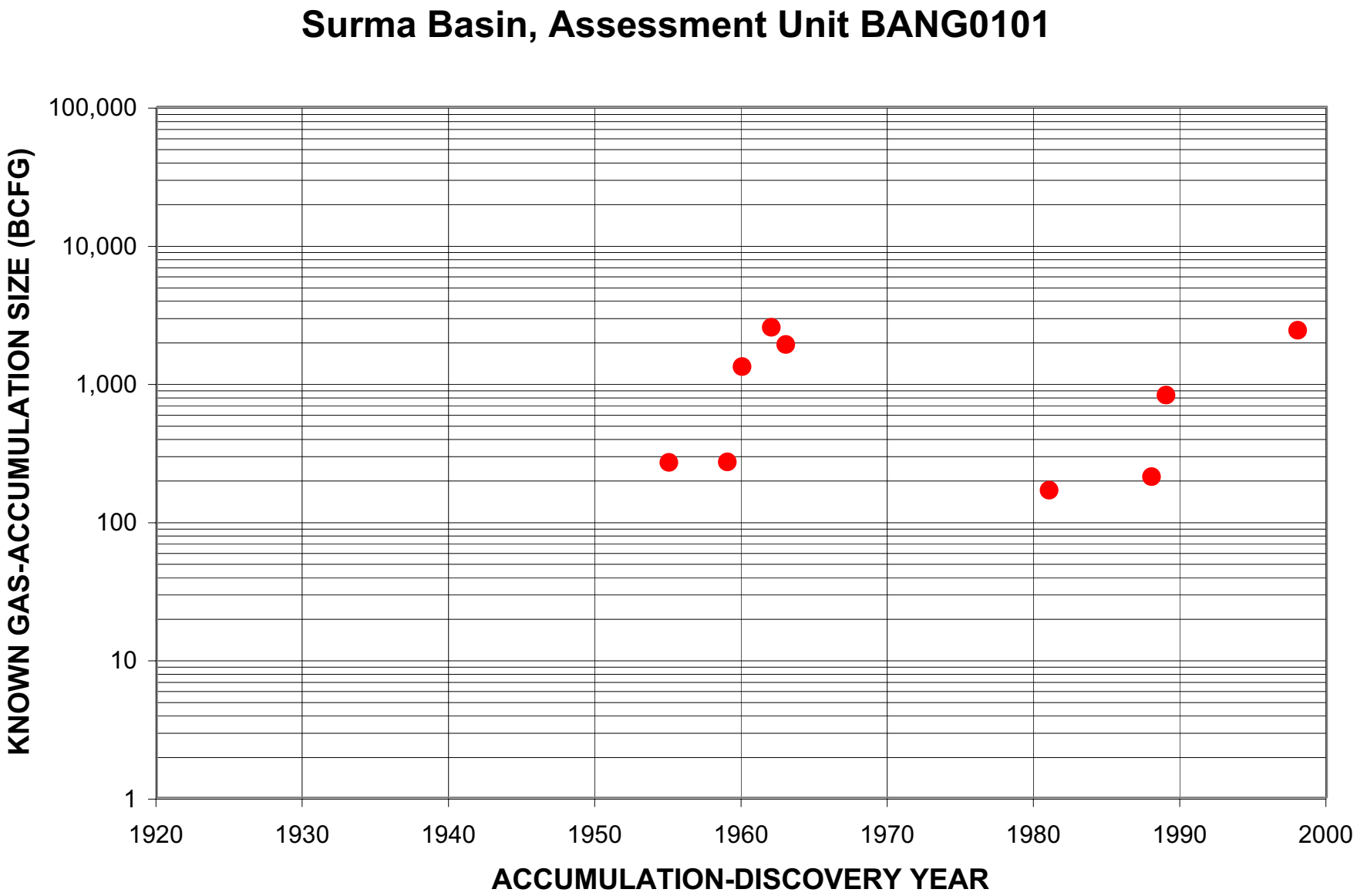

Surma Basin, Assessment Unit BANG0101
CUM. NEW-FIELD WILDCAT WELLS (No.)
0
2
4
6
8
10
12
14
1920
1930
1940
1950
1960
1970
1980
1990
2000
DRILLING-COMPLETION YEAR

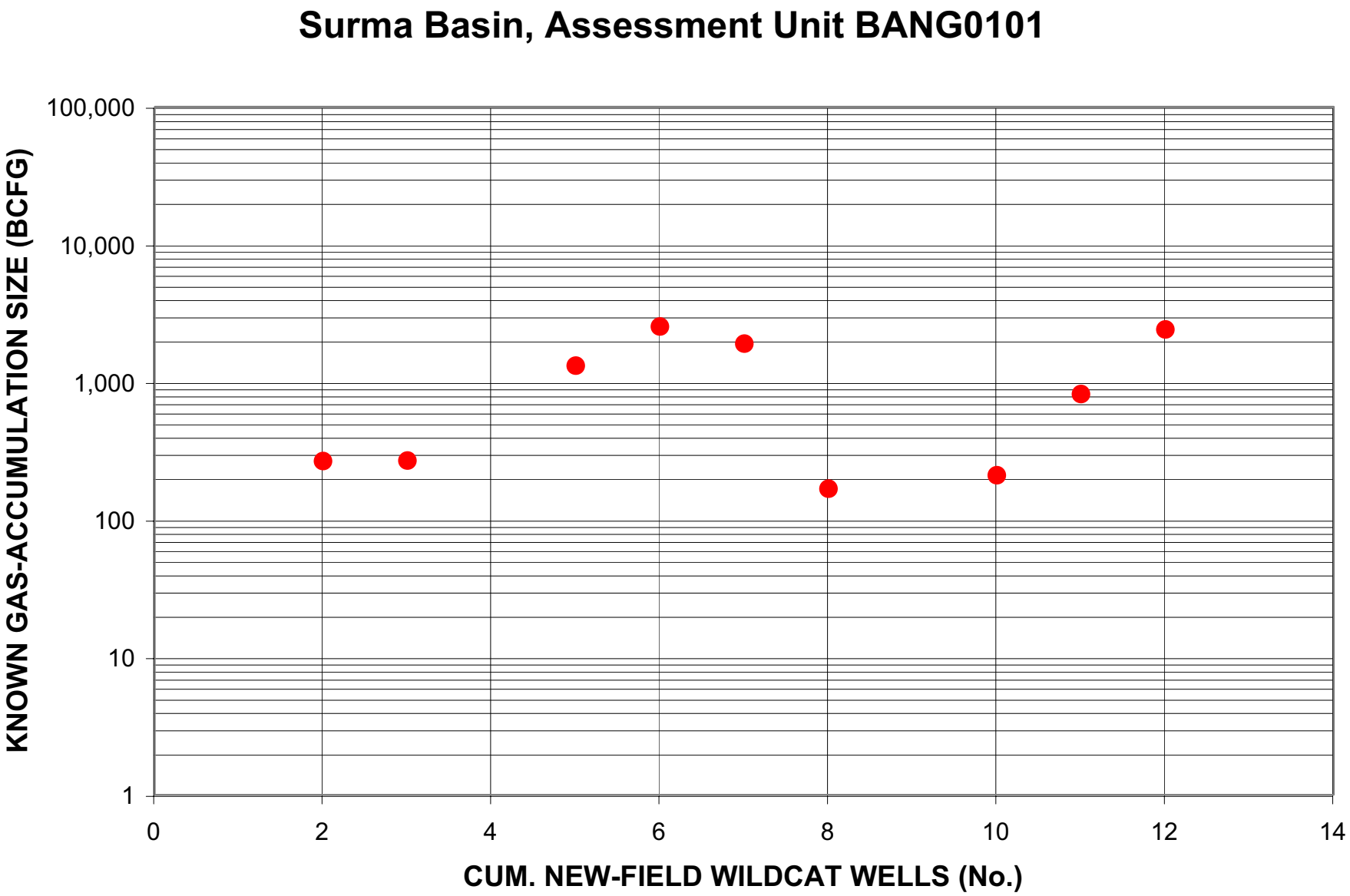

Surma Basin, Assessment Unit BANG0101
NEW-FIELD WILDCAT WELLS (No.)
0
1
2
3
1923
1926
1929
1932
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
DRILLING-COMPLETION YEAR

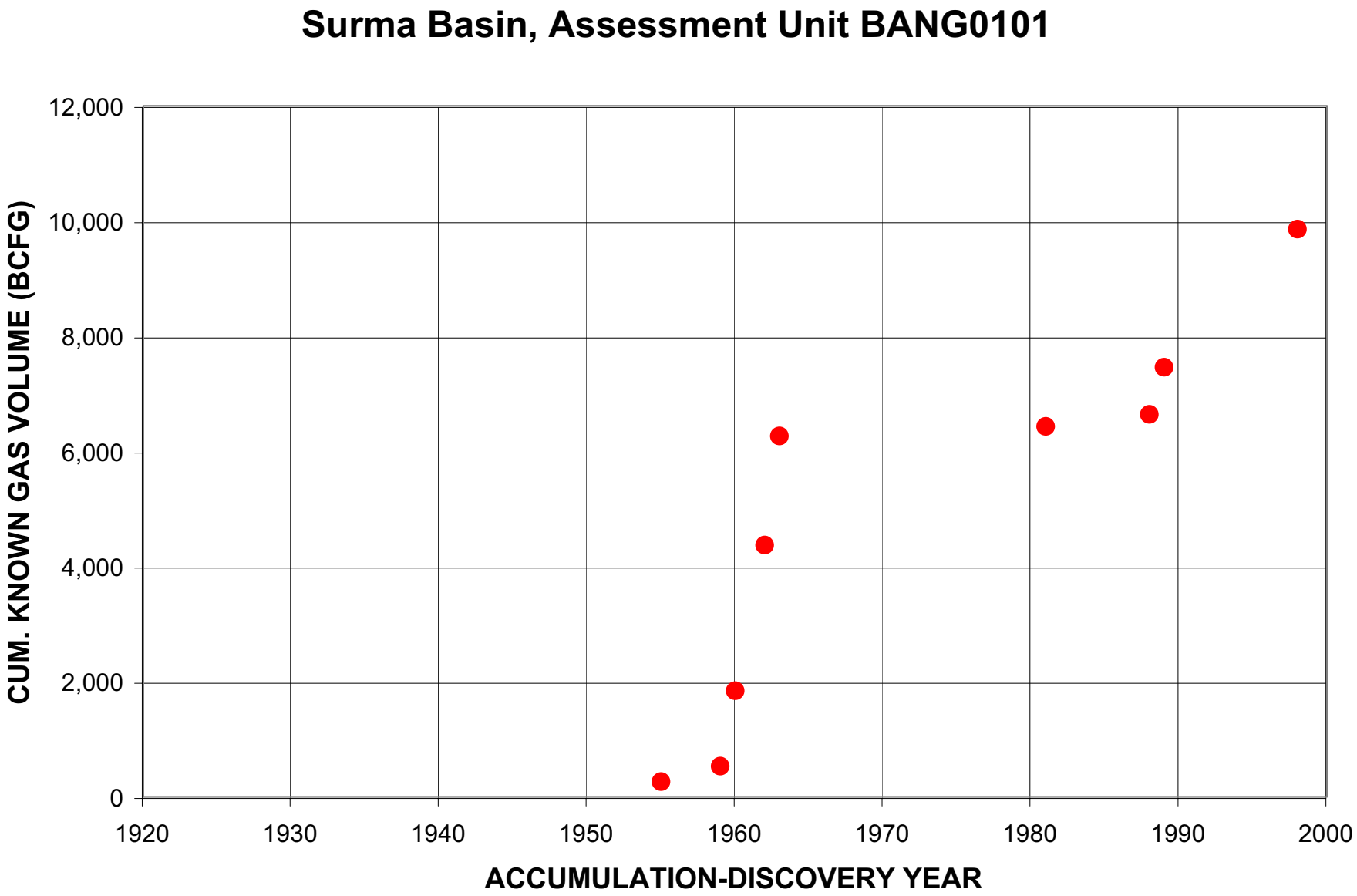

Surma Basin, Assessment Unit BANG0101
KNOWN GAS-ACCUMULATION SIZE (BCFG)
100,000
10,000
1,000
100
10
1
0
1
2
3
4
5
6
GAS-ACCUMULATION RANK BY SIZE
First half of accumulations discovered
Second half of accumulations discovered

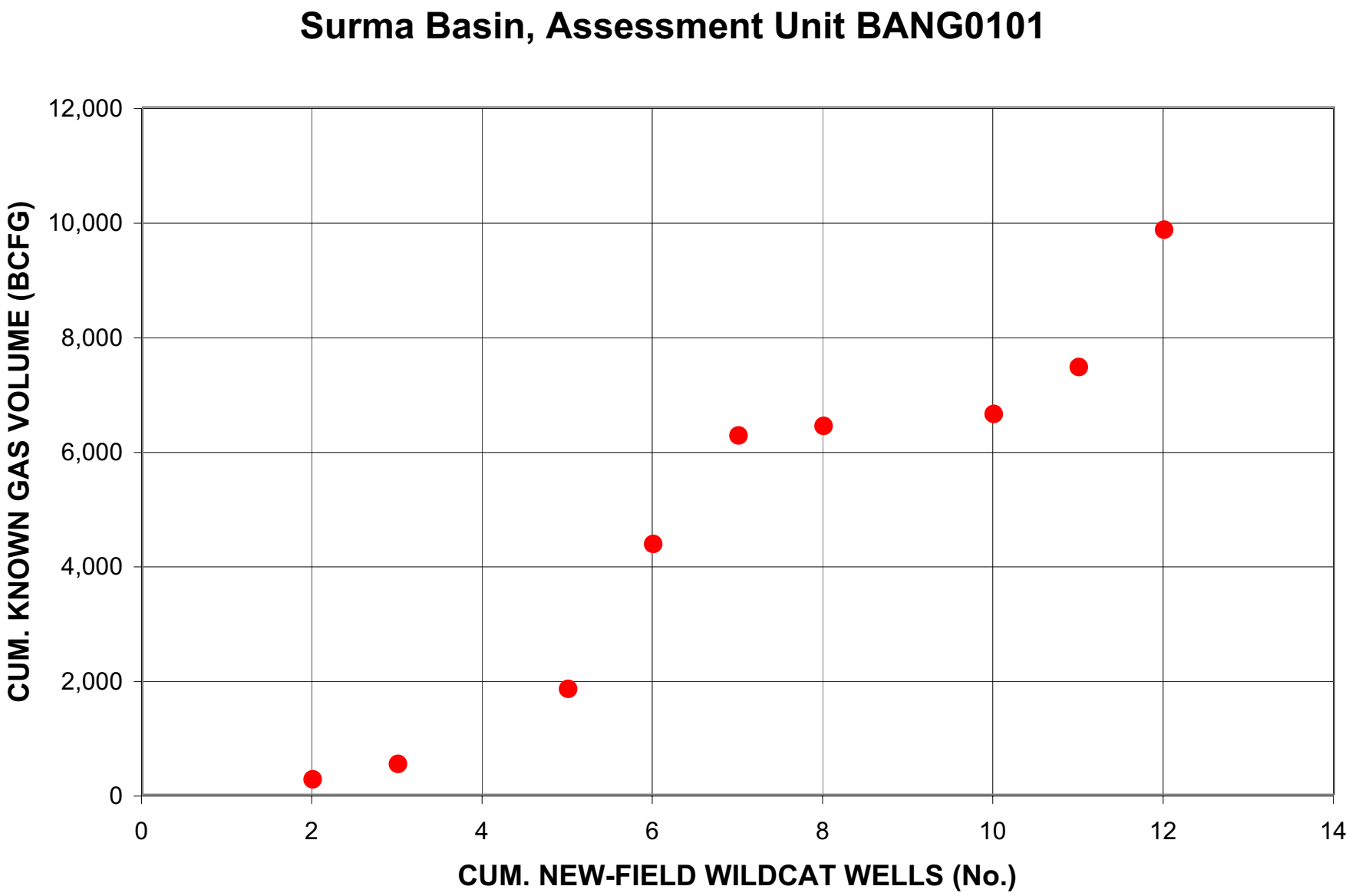

Surma Basin, Assessment Unit BANG0101
GAS ACCUMULATIONS (No.)
0
1
2
3
4
6 to <12
12 to <24
24 to <48
48 to <96
96 to <192
192 to <384
384 to <768
768 to <1,536
1,536 to <3,072
3,072 to <6,144
6,144 to <12,288
12,288 to <24,576
24,576 to <49,152
49,152 to <98,304
98,304 to <196,608
196,608 to <393,216
393,216 to <786,432
786,432 to <1,572,864
>=1,572,864
KNOWN GAS-ACCUMULATION SIZE (BCFG)
Second half of accumulations discovered
First half of accumulations discovered

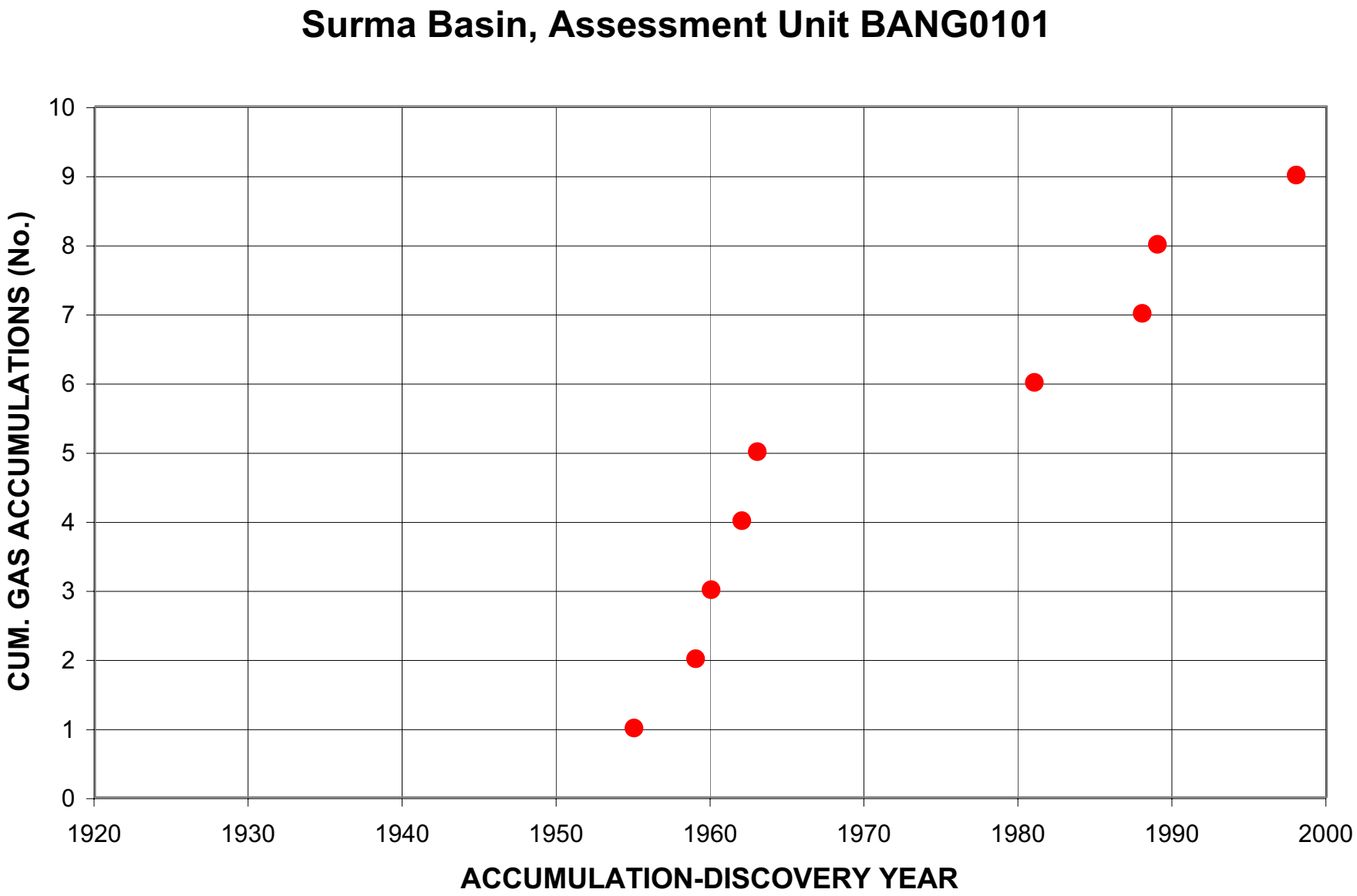

Surma Basin, Assessment Unit BANG0101
VOLUME OF GAS (BCFG)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
6 to <12
12 to <24
24 to <48
48 to <96
96 to <192
192 to <384
384 to <768
768 to <1,536
1,536 to <3,072
3,072 to <6,144
6,144 to <12,288
12,288 to <24,576
24,576 to <49,152
49,152 to <98,304
98,304 to <196,608
196,608 to <393,216
393,216 to <786,432
786,432 to <1,572,864
>=1,572,864
KNOWN GAS-ACCUMULATION SIZE (BCFG)

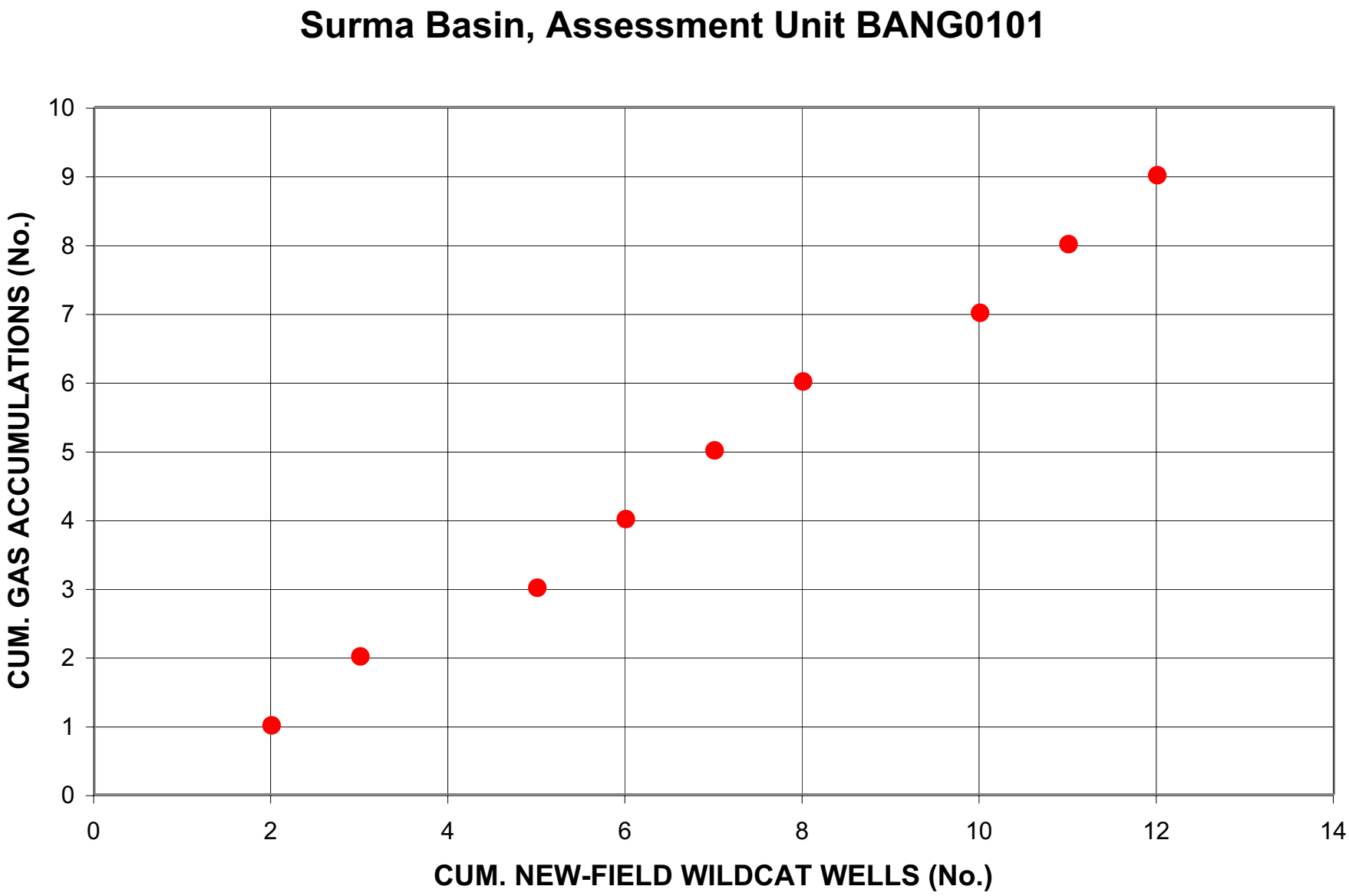

Surma Basin, Assessment Unit BANG0101
KNOWN GAS-ACCUMULATION SIZE (BCFG)
100,000
10,000
1,000
100
10
1
1920
1930
1940
1950
1960
1970
1980
1990
2000
ACCUMULATION-DISCOVERY YEAR

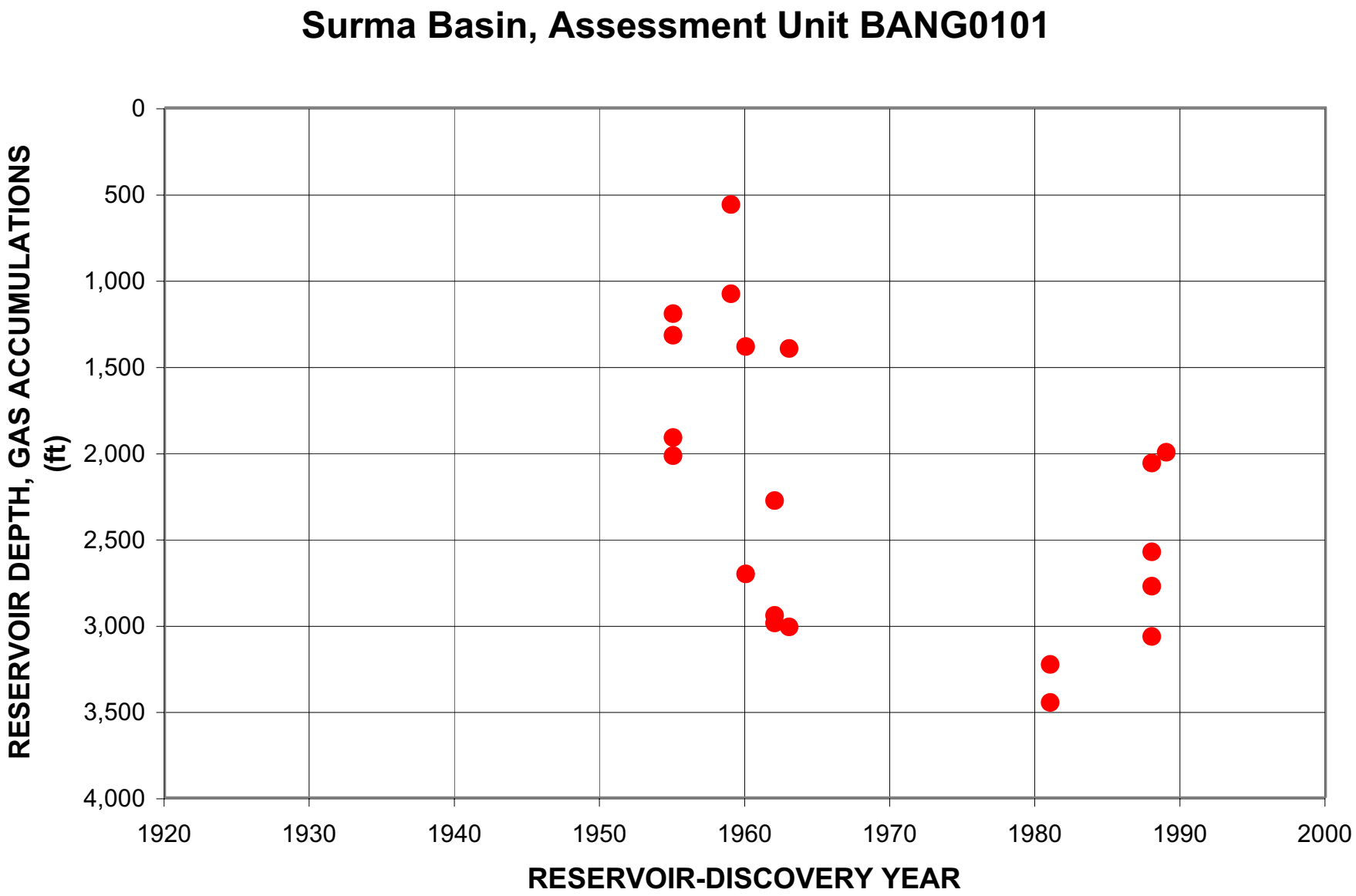

Surma Basin, Assessment Unit BANG0101
KNOWN GAS-ACCUMULATION SIZE (BCFG)
100,000
10,000
1,000
100
10
1
0
2
4
6
8
10
12
14
CUM. NEW-FIELD WILDCAT WELLS (No.)

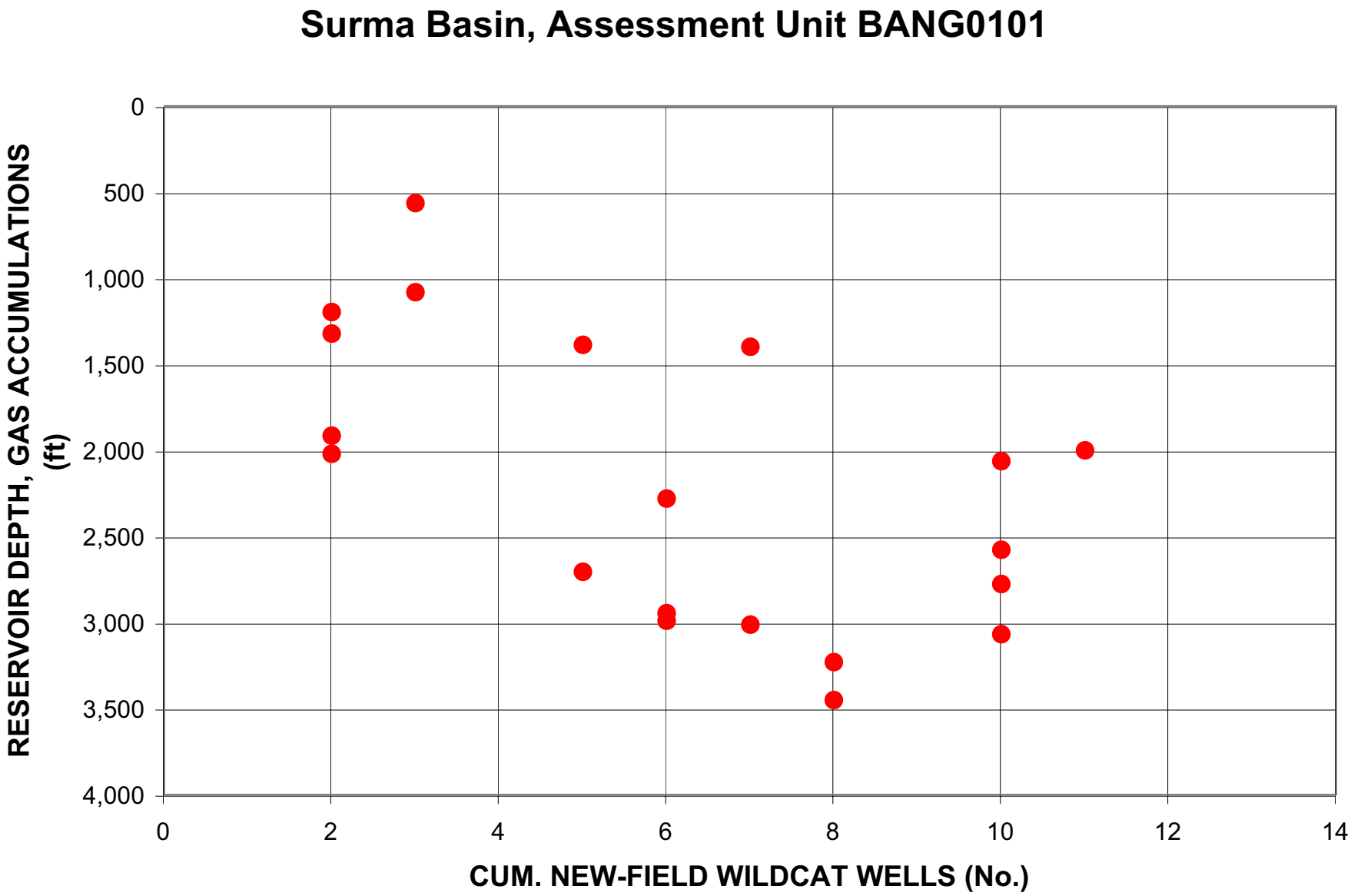

Surma Basin, Assessment Unit BANG0101
CUM. KNOWN GAS VOLUME (BCFG)
12,000
10,000
8,000
6,000
4,000
2,000
0
1920
1930
1940
1950
1960
1970
1980
1990
2000
ACCUMULATION-DISCOVERY YEAR

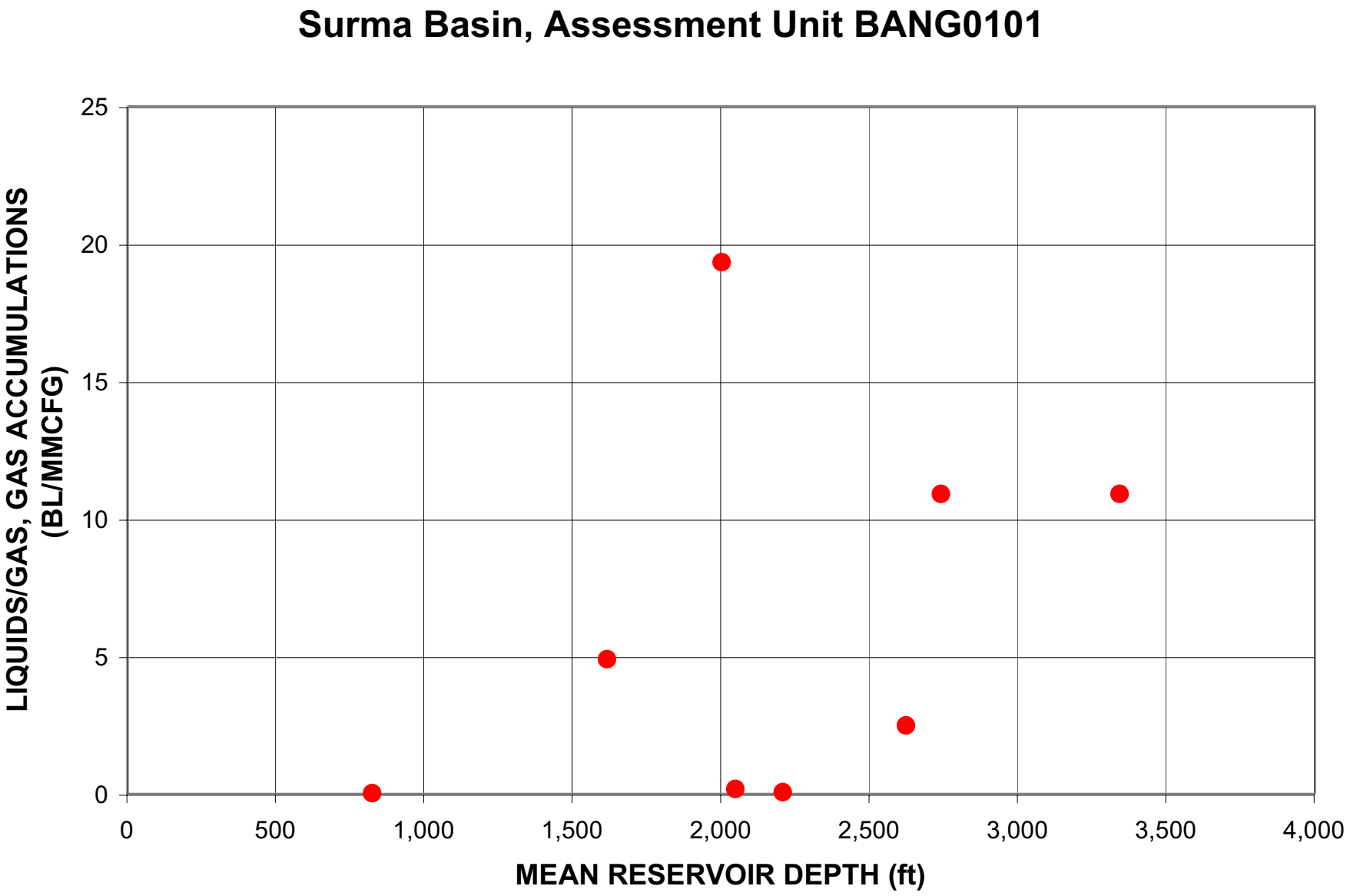

Surma Basin, Assessment Unit BANG0101
CUM. KNOWN GAS VOLUME (BCFG)
12,000
10,000
8,000
6,000
4,000
2,000
0
0
2
4
6
8
10
12
14
CUM. NEW-FIELD WILDCAT WELLS (No.)


Surma Basin, Assessment Unit BANG0101
CUM. GAS ACCUMULATIONS (No.)
0
1
2
3
4
5
6
7
8
9
10
1920
1930
1940
1950
1960
1970
1980
1990
2000
ACCUMULATION-DISCOVERY YEAR


Surma Basin, Assessment Unit BANG0101
CUM. GAS ACCUMULATIONS (No.)
0
1
2
3
4
5
6
7
8
9
10
0
2
4
6
8
10
12
14
CUM. NEW-FIELD WILDCAT WELLS (No.)


Surma Basin, Assessment Unit BANG0101
RESERVOIR DEPTH, GAS ACCUMULATIONS (ft)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
1920
1930
1940
1950
1960
1970
1980
1990
2000
RESERVOIR-DISCOVERY YEAR

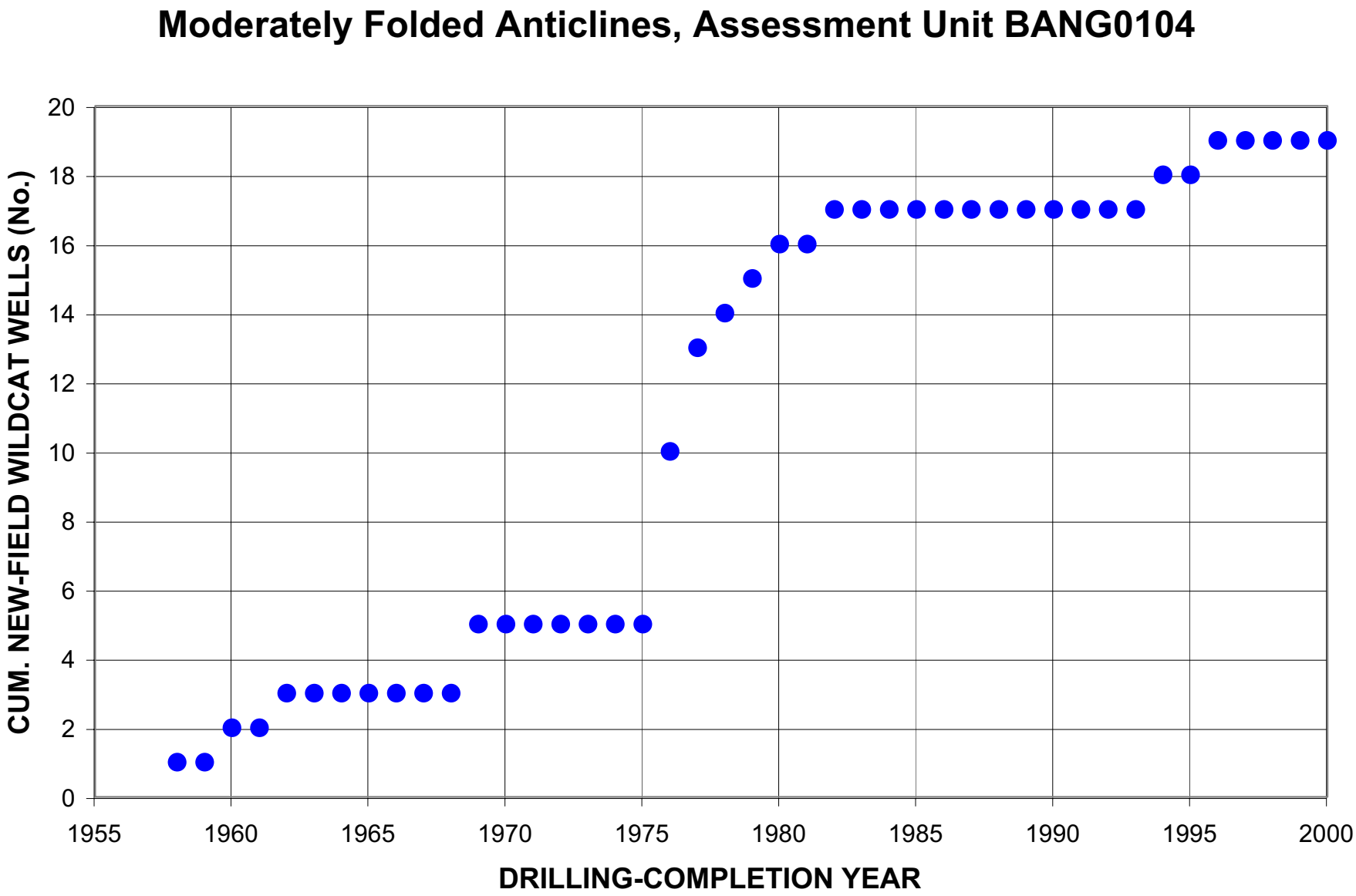

Surma Basin, Assessment Unit BANG0101
RESERVOIR DEPTH, GAS ACCUMULATIONS (ft)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
0
2
4
6
8
10
12
14
CUM. NEW-FIELD WILDCAT WELLS (No.)


Surma Basin, Assessment Unit BANG0101
LIQUIDS/GAS, GAS ACCUMULATIONS (BL/MMCFG)
25
20
15
10
5
0
0
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
MEAN RESERVOIR DEPTH (ft)

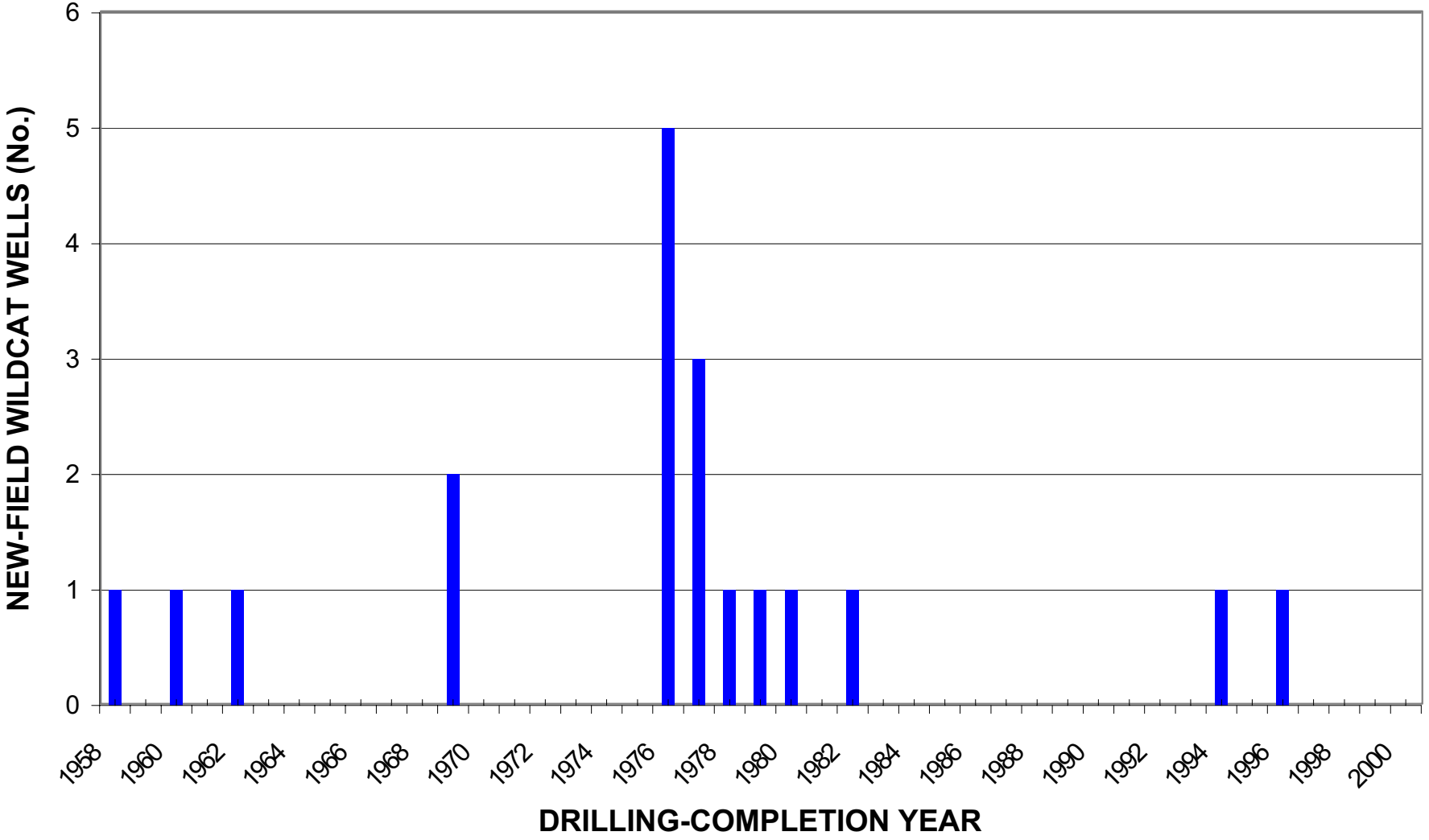
Assessment Unit Bang0104 Moderately Folded Anticlines Known Data

Moderately Folded Anticlines, Assessment Unit BANG0104
Known Data

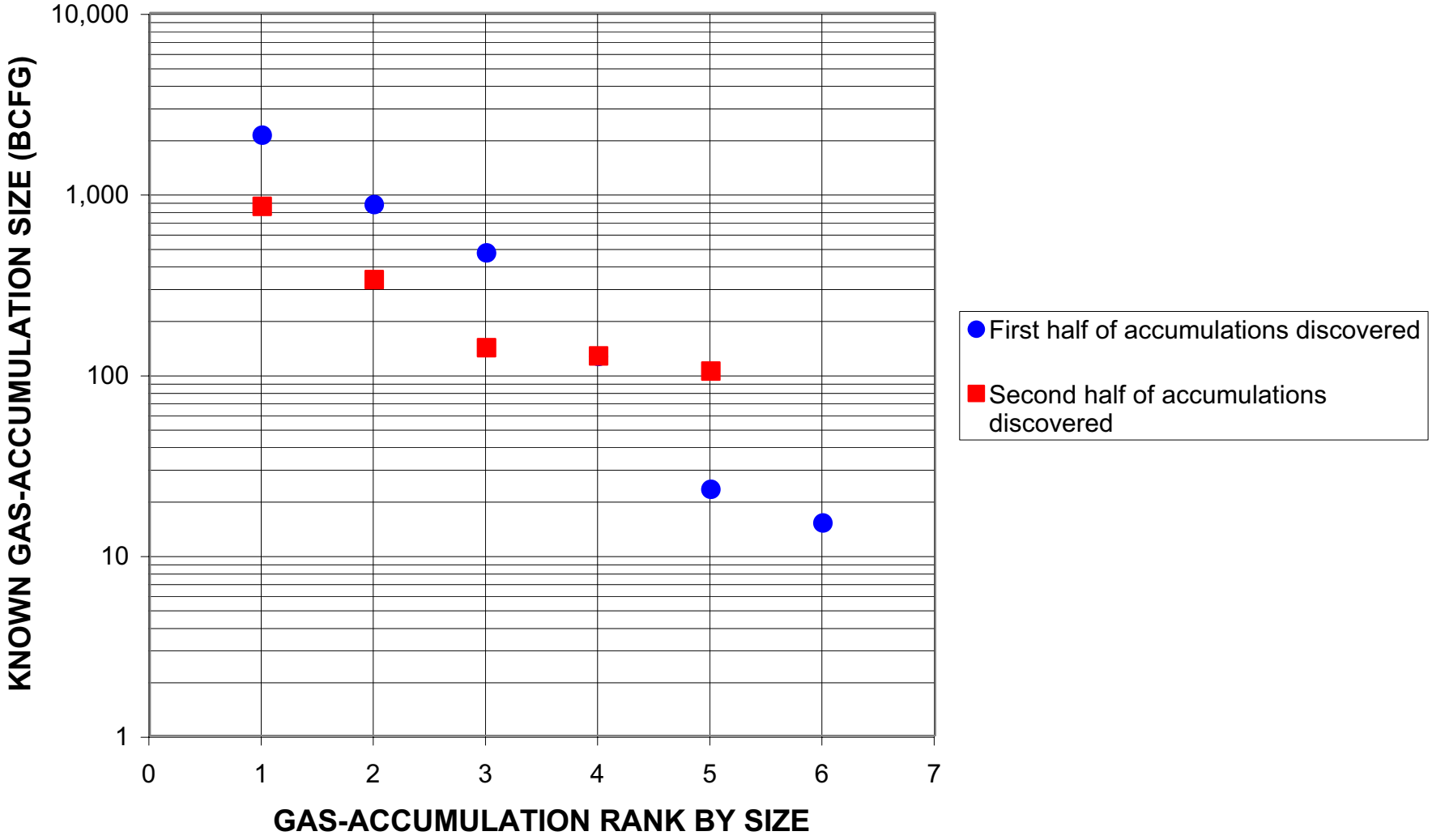
First half of accumulations discovered		*Second half of accumulations discovered*		*Total Gas (BCFG)*	
Mean	599.6666667	Mean	310.2	Mean	468.0909091
Standard Error	328.6077364	Standard Error	140.5640068	Standard Error	187.4027483
Median	296.5	Median	140	Median	140
Mode	#N/A	Mode	#N/A	Mode	#N/A
Standard Deviation	804.9212798	Standard Deviation	314.3106743	Standard Deviation	621.5446009
Sample Variance	647898.2667	Sample Variance	98791.2	Sample Variance	386317.6909
Kurtosis	2.672524398	Kurtosis	3.20062181	Kurtosis	4.772453039
Skewness	1.66565334	Skewness	1.819735516	Skewness	2.095441996
Range	2085	Range	744	Range	2085
Minimum	15	Minimum	104	Minimum	15
Maximum	2100	Maximum	848	Maximum	2100
Sum	3598	Sum	1551	Sum	5149
Count	6	Count	5	Count	11
Number of Years	20	Number of Years	14	Number of Years	34
First Year of First Half or First Third	Last Year of First Half or First Third	First Year of Second Half or Second Third	Last Year of Second Half or Second Third		
1962	1982	1990	1996		


Moderately Folded Anticlines, Assessment Unit BANG0104
CUM. NEW-FIELD WILDCAT WELLS (No.)
0
2
4
6
8
10
12
14
16
18
20
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
DRILLING-COMPLETION YEAR

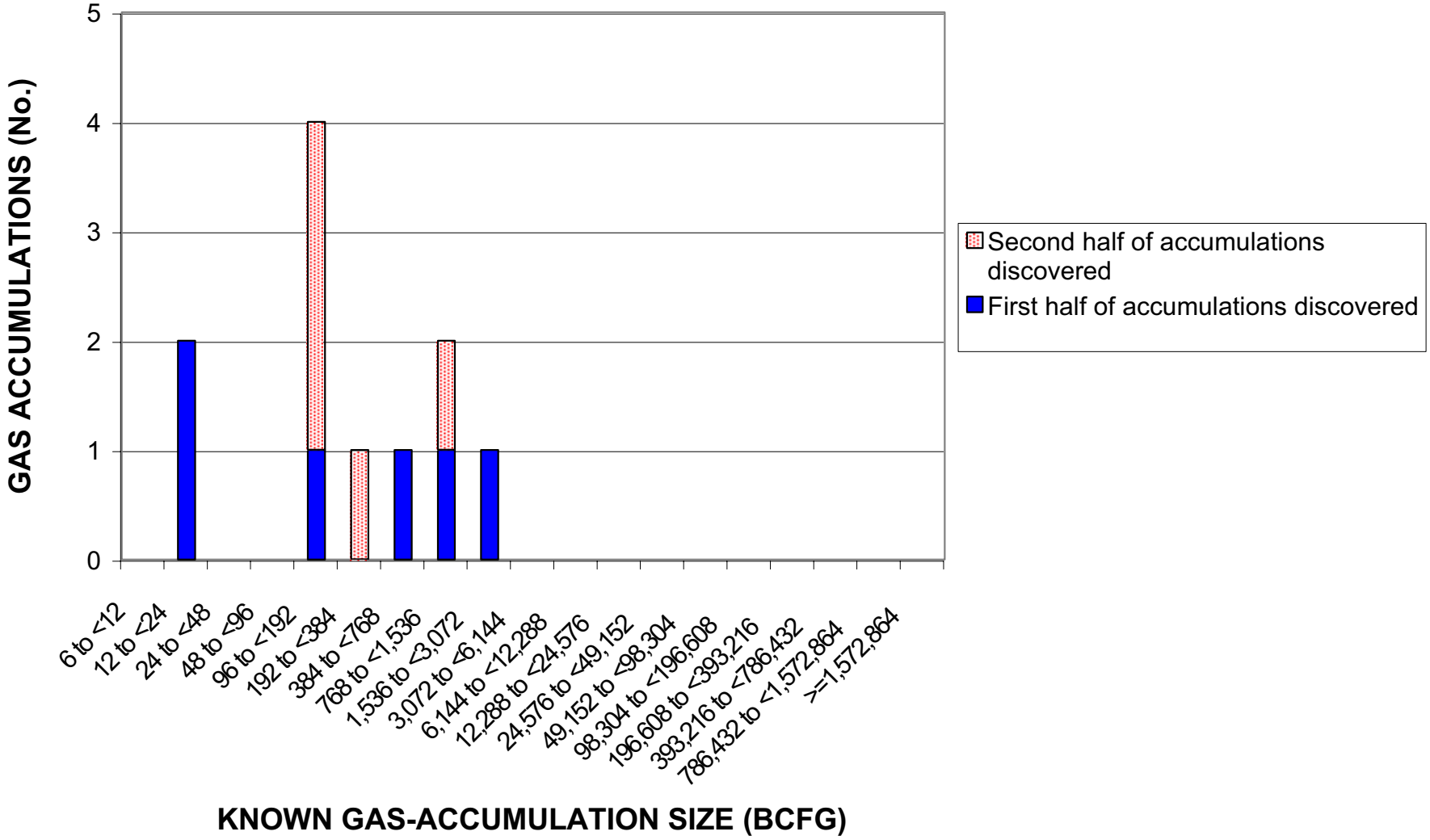
Moderately Folded Anticlines, Assessment Unit BANG0104

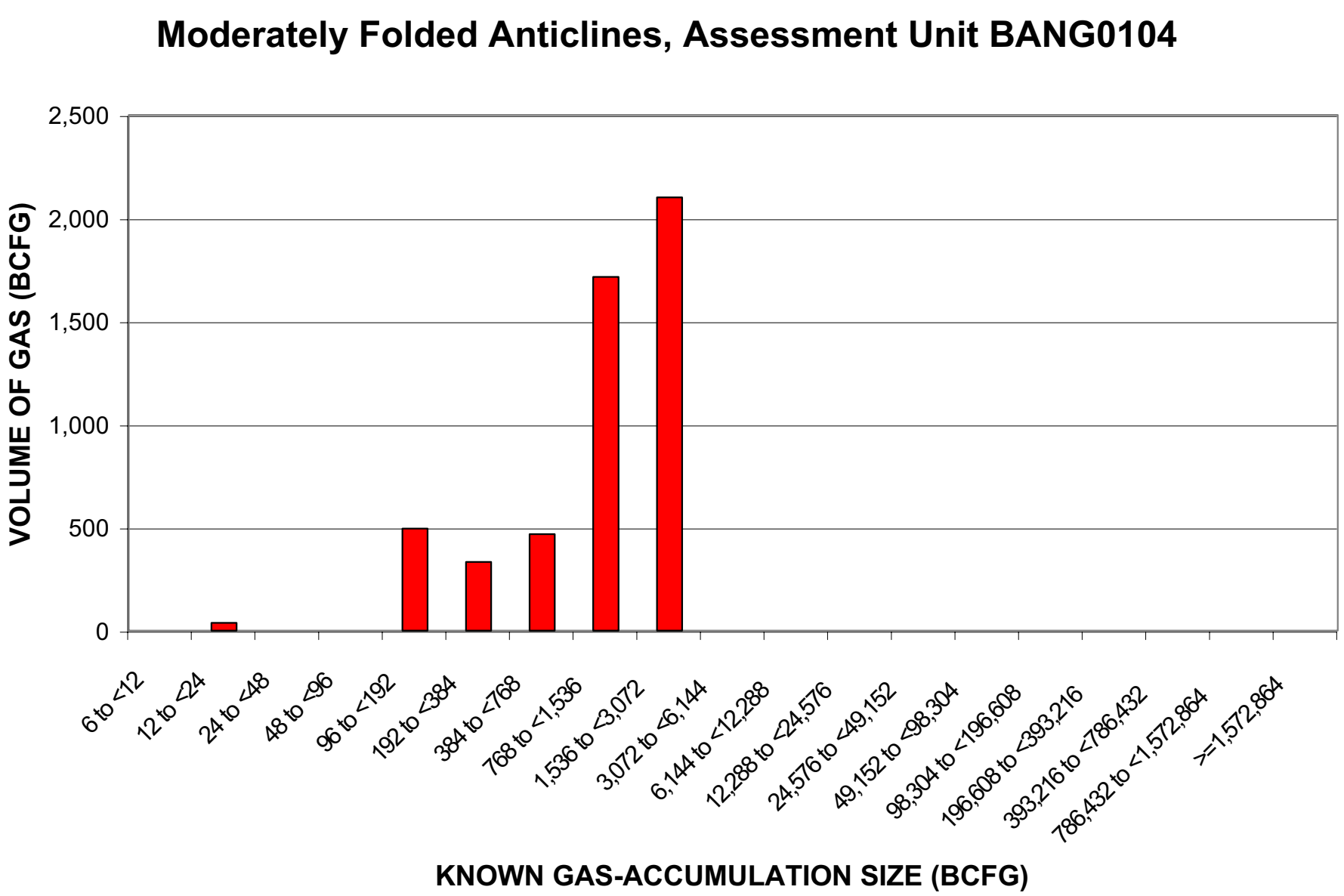


Moderately Folded Anticlines, Assessment Unit BANG0104

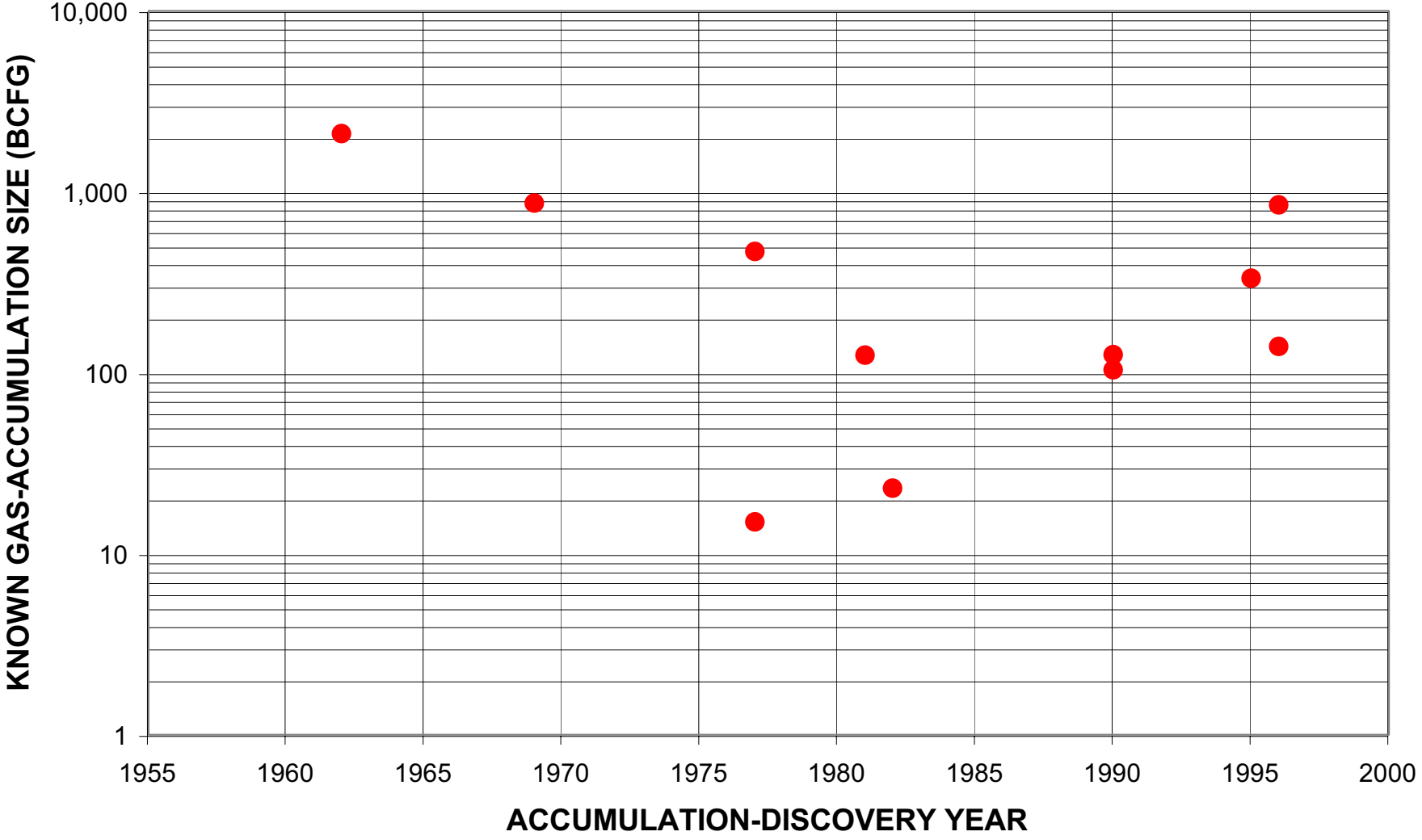


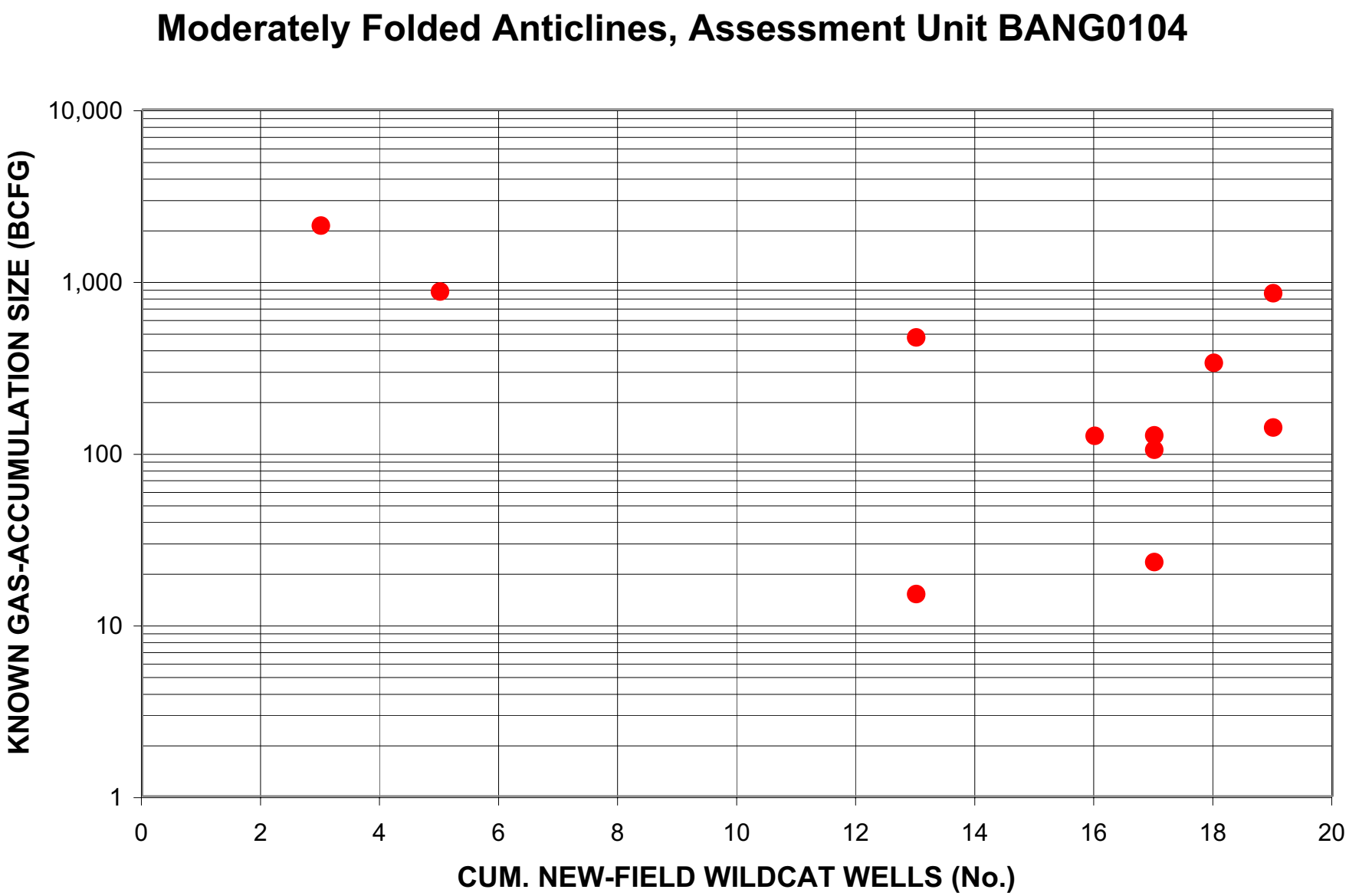
Moderately Folded Anticlines, Assessment Unit BANG0104

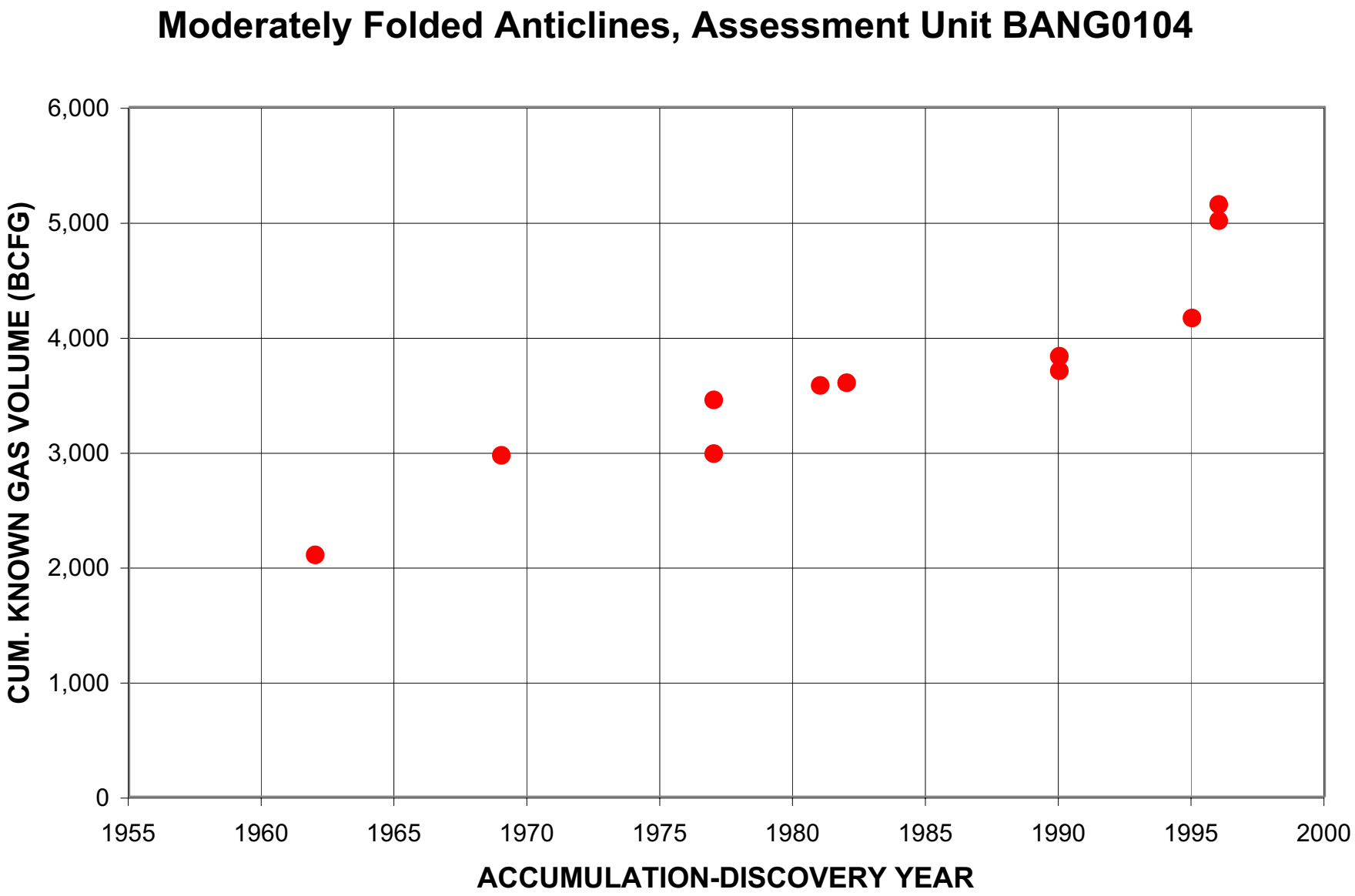


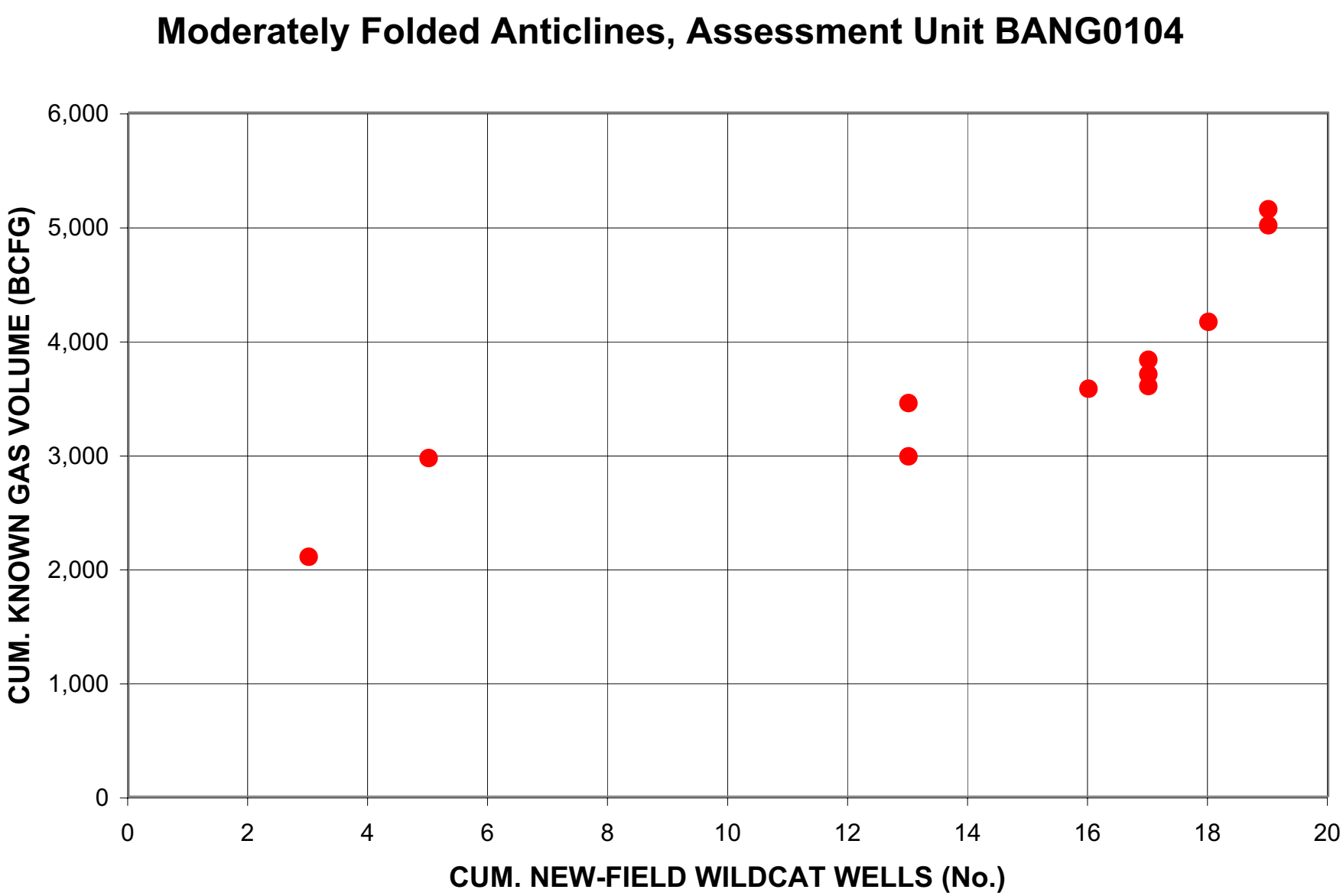

Moderately Folded Anticlines, Assessment Unit BANG0104
VOLUME OF GAS (BCFG)
2,500
2,000
1,500
1,000
500
0
6 to <12
12 to <24
24 to <48
48 to <96
96 to <192
192 to <384
384 to <768
768 to <1,536
1,536 to <3,072
3,072 to <6,144
6,144 to <12,288
12,288 to <24,576
24,576 to <49,152
49,152 to <98,304
98,304 to <196,608
196,608 to <393,216
393,216 to <786,432
786,432 to <1,572,864
>=1,572,864
KNOWN GAS-ACCUMULATION SIZE (BCFG)

Moderately Folded Anticlines, Assessment Unit BANG0104

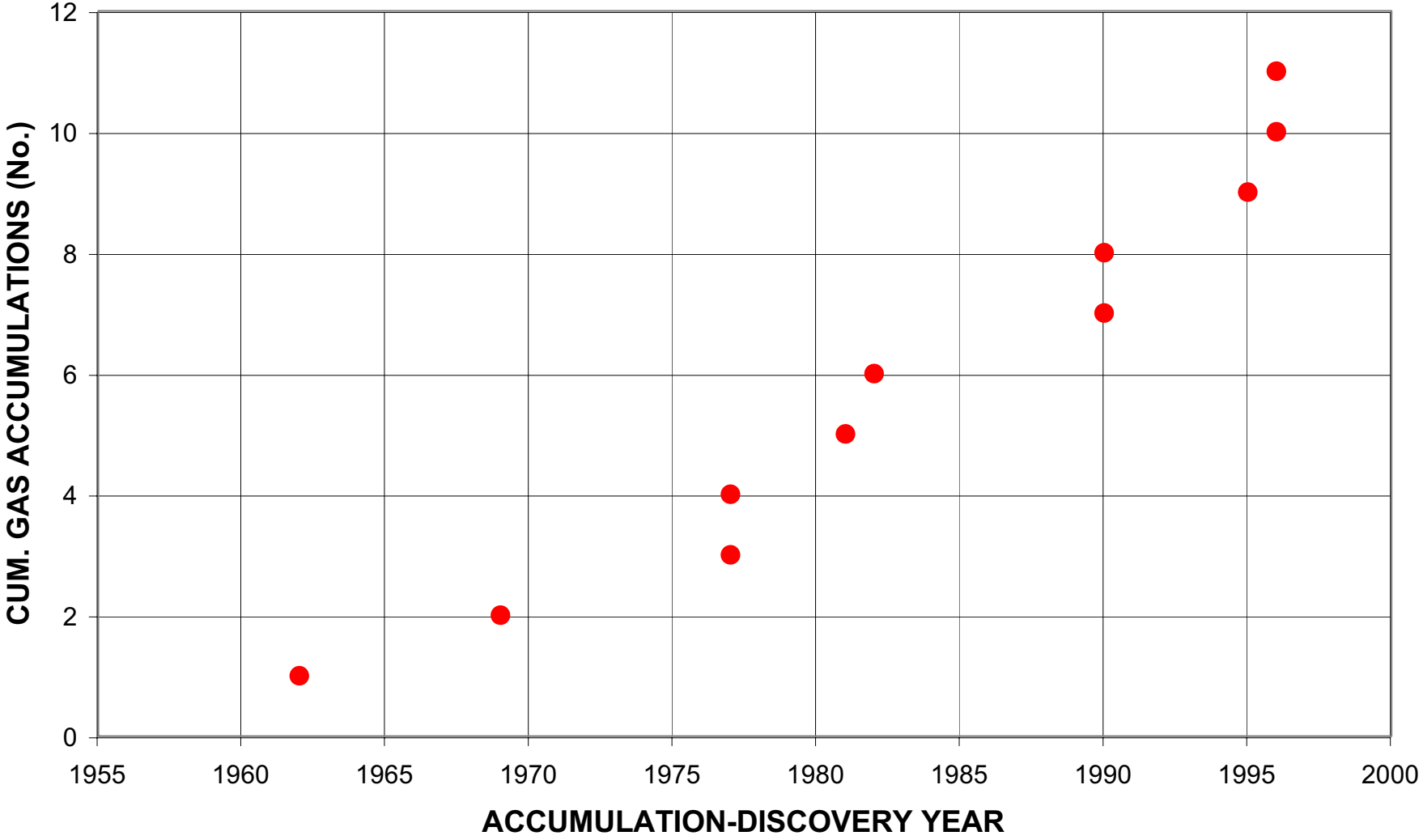


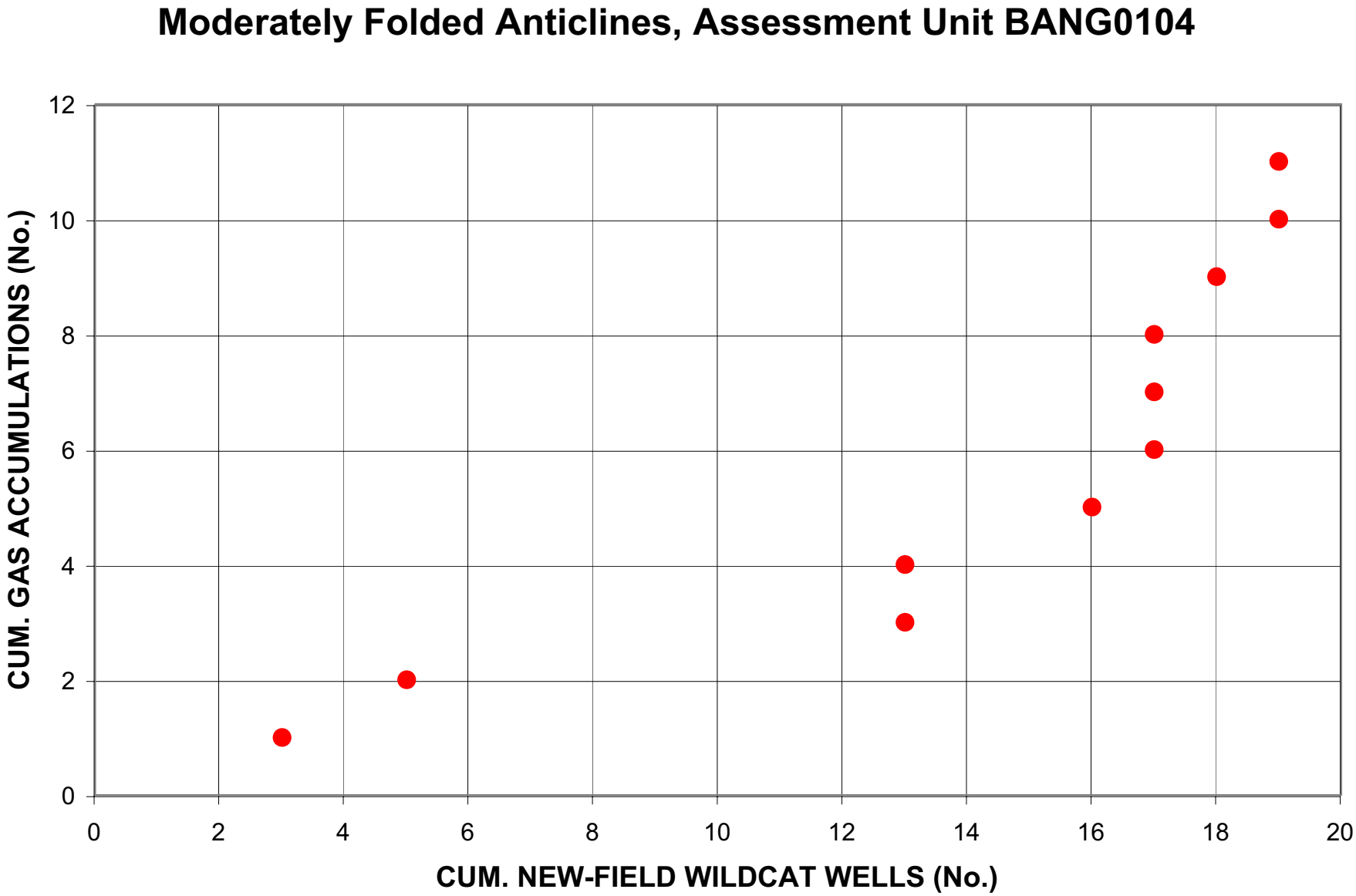

Moderately Folded Anticlines, Assessment Unit BANG0104
KNOWN GAS-ACCUMULATION SIZE (BCFG)
10,000
1,000
100
10
1
0
2
4
6
8
10
12
14
16
18
20
CUM. NEW-FIELD WILDCAT WELLS (No.)

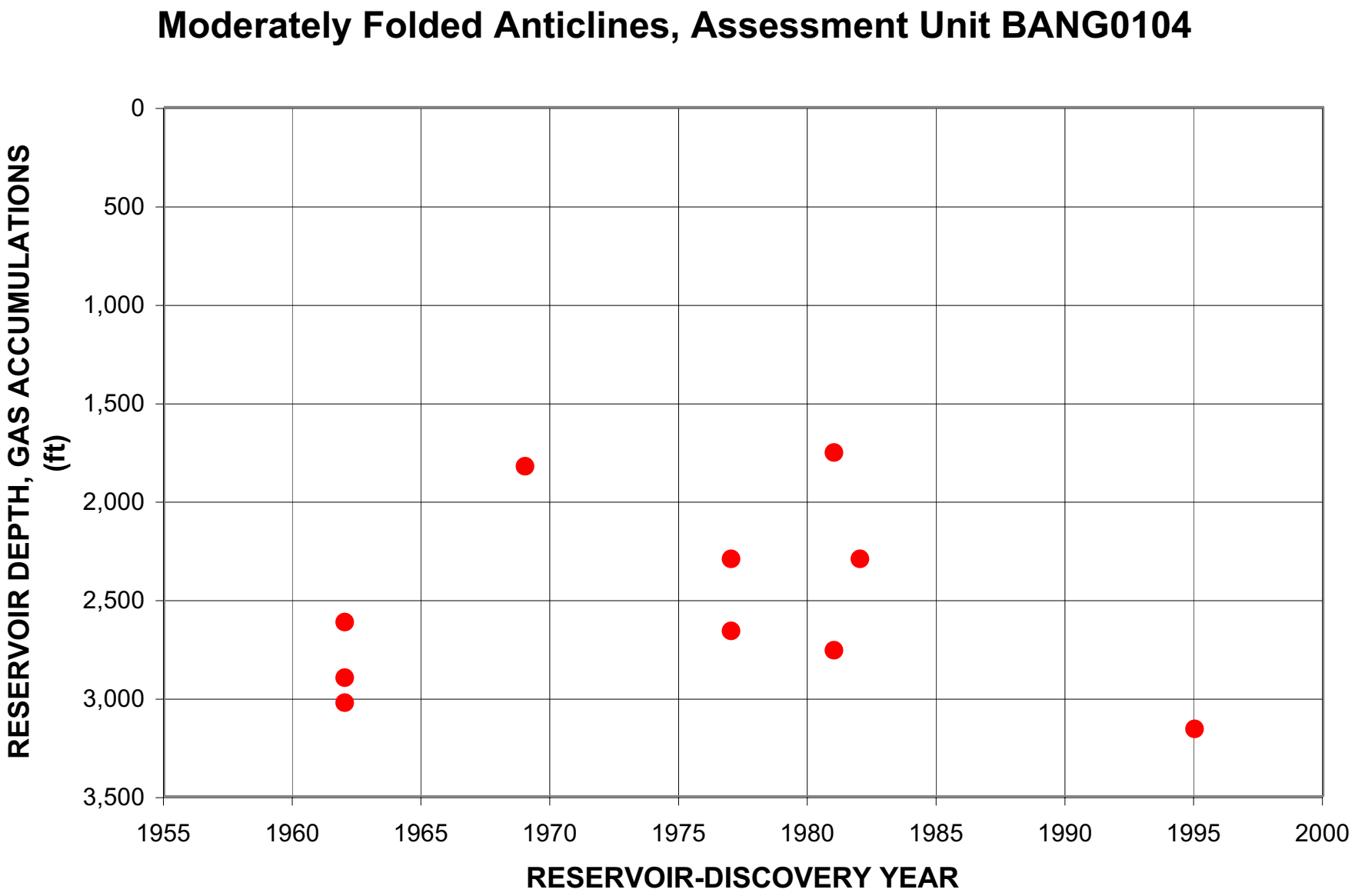

Moderately Folded Anticlines, Assessment Unit BANG0104
CUM. KNOWN GAS VOLUME (BCFG)
6,000
5,000
4,000
3,000
2,000
1,000
0
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
ACCUMULATION-DISCOVERY YEAR

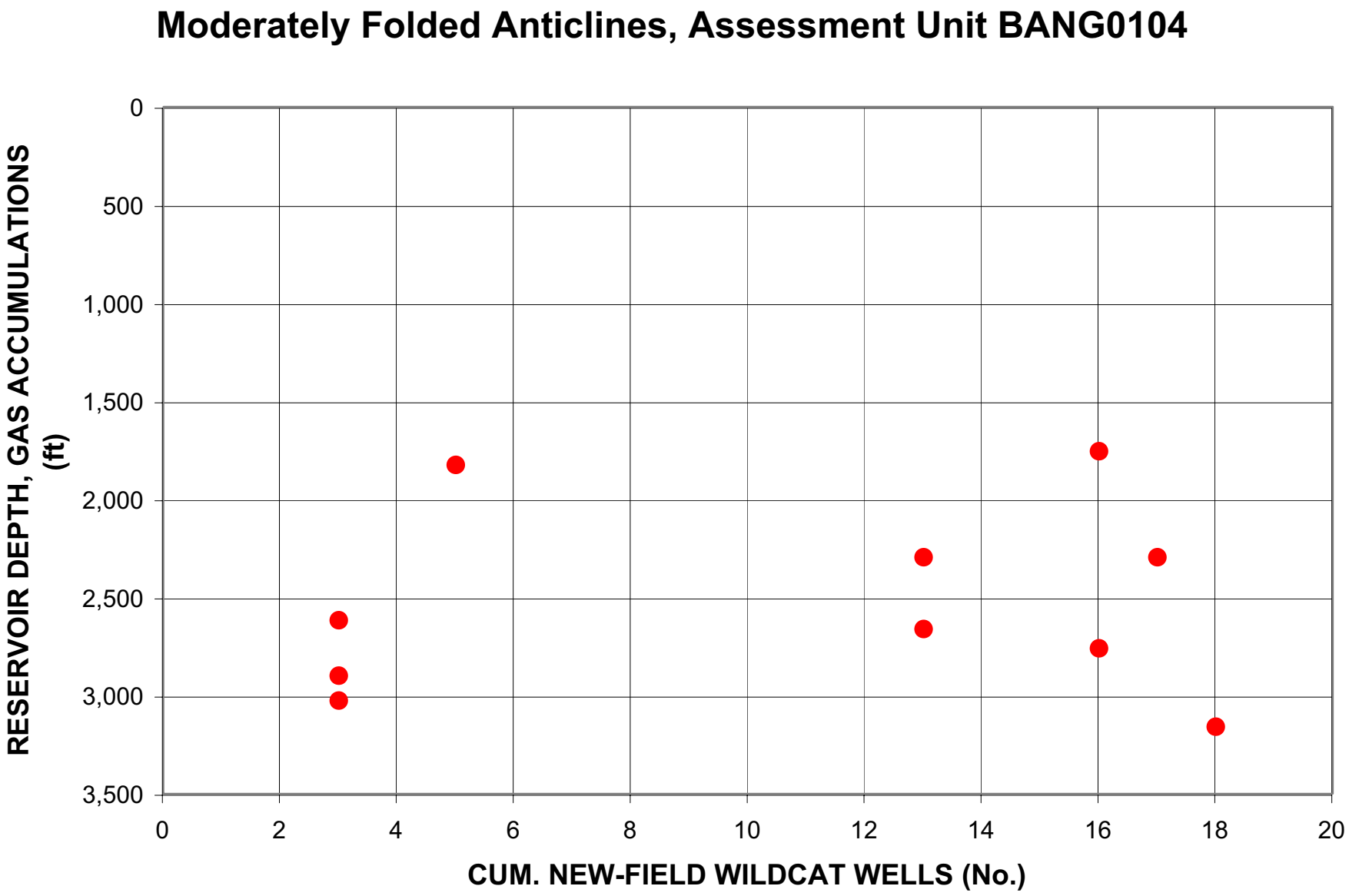

Moderately Folded Anticlines, Assessment Unit BANG0104
CUM. KNOWN GAS VOLUME (BCFG)
6,000
5,000
4,000
3,000
2,000
1,000
0
0
2
4
6
8
10
12
14
16
18
20
CUM. NEW-FIELD WILDCAT WELLS (No.)

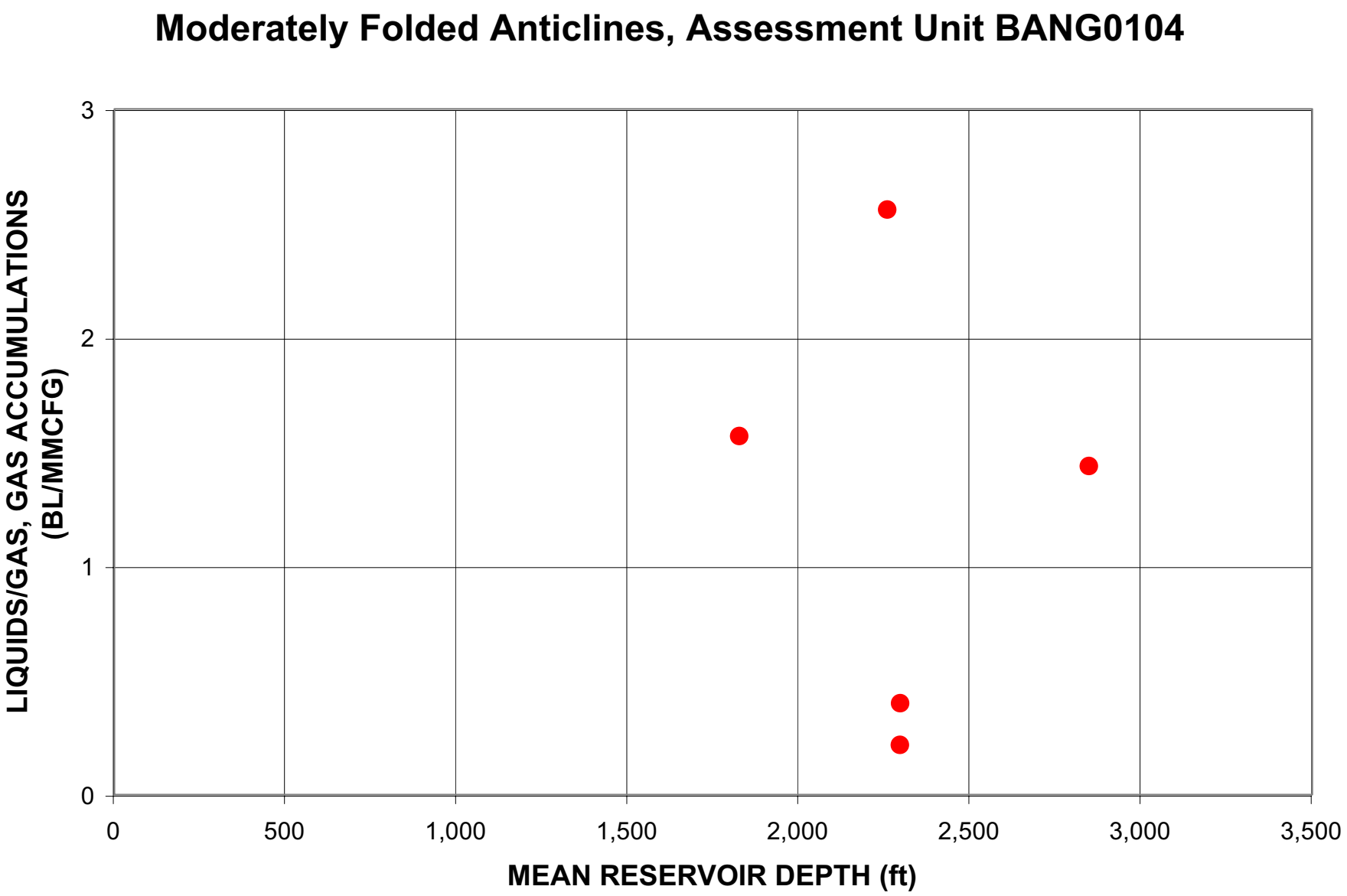
Moderately Folded Anticlines, Assessment Unit BANG0104




Moderately Folded Anticlines, Assessment Unit BANG0104
CUM. GAS ACCUMULATIONS (No.)
0
2
4
6
8
10
12
CUM. NEW-FIELD WILDCAT WELLS (No.)
0
2
4
6
8
10
12
14
16
18
20


Moderately Folded Anticlines, Assessment Unit BANG0104
RESERVOIR DEPTH, GAS ACCUMULATIONS (ft)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
RESERVOIR-DISCOVERY YEAR


Moderately Folded Anticlines, Assessment Unit BANG0104
RESERVOIR DEPTH, GAS ACCUMULATIONS (ft)
0
500
1,000
1,500
2,000
2,500
3,000
3,500
0
2
4
6
8
10
12
14
16
18
20
CUM. NEW-FIELD WILDCAT WELLS (No.)


Moderately Folded Anticlines, Assessment Unit BANG0104
LIQUIDS/GAS, GAS ACCUMULATIONS (BL/MMCFG)
3
2
1
0
0
500
1,000
1,500
2,000
2,500
3,000
3,500
MEAN RESERVOIR DEPTH (ft)