

History of Petroleum Geology in Georgia*

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Abstract

The history of petroleum geology in Georgia can be divided into three parts: from ancient times until 1929, 1929-1994 (“Georgian Oil” times), and from 1994 until present. Those periods vary in both oil production methods and achievements.

Surface oil seeps in Georgia ([Figure 1](#)) have been known since ancient times. Multiple historical documents written by travelers of the Middle Ages are found which include records of trading oil produced in Georgia from both the west and east parts of the country. At that time, the only way of producing oil was directly collecting from surface oil seeps or at most digging shallow pits. And as in most parts of the world, no geological surveys were done. Different local and foreign entities started their ventures in Georgia producing oil this way without doing any geological surveys. Well drilling first started at the end of this period, which lasted until 1929 when The Trust “Georgian Oil” was established. The oil was used not only for fuel and lighting, but also as a lubricant and in medicine.

In first half of the 19th century oil was produced in Guria (west Georgia), Patara Shiraki and Eldari valleys (southeast Georgia), and Navtlugi (in Tbilisi surrounding) by digging shallow pits and wells around surface oil seeps, which the collected oil from these seeps. And during this period there was significant oil being imported from neighboring Azerbaijan (where the first oil well in the world was drilled in 1846) which led to a rise of interest searching for domestic oil in Georgia which in turn led to leasing and trading of oil productive lands. So in the middle of 19th century most of the oil prospective lands were under private ownership, which negatively influenced the oil business because private land holders were not interested in exploration geology but preferred production of oil with old primitive ways. The importance of geological surveys was realized in the middle of the 19th century (since 1847) when, together with Russian geologists, more serious geological research was begun. However, production activity continued to use old methods.

Early Drilling

Oil drilling started in Georgia in 1869 by Walter Siemens, a Prussian, who got licenses for Shiraki, Mirzaani and Eldari (southeast Georgia). The first wells were 38, 18, 15 m deep and initially they were producing 10-17 bopd. Soon oil production in southeast Georgia tripled up to 14,000 bbls of oil per year (from approximately 70 producing wells). Then Siemens build two oil refineries and started production of petrol, gasoline, naphta, car oil and light oil. Besides oil production with this method dropped to 8,000 bbls in 1890 Siemens's experience was applied in all other oil producing regions of Georgia and his activity attracted more interest of Georgian, Russian and Armenian oil businessmen to Georgia. That is why many new oil producing corporations appeared throughout Georgia, however oil production had remained at the same level and without knowing any geology of the areas - consequently oil production was dropping fast.

World War I brought oil production in Georgia almost to zero and all the oil refineries closed which lead to an increase of oil prices in the country and import volumes from Azerbaijan. After formation of the Soviet Union, oil exploration continued with the same primitive methods (drilling very shallow wells) by private and state owned companies. In 1928 Italian-Belgian mining consortium drilled the first deep well (540 m), which flowed oil.

“Georgian Oil” Era

Neither private nor state owned companies achieved success, which led to the decision to create an organization specifically for geological exploration of oil, and the second and most important era of oil business in Georgia started related to State National Oil Company “Georgian Oil”. Soviet government formed this state organization after it was realized that Georgia had the potential for hydrocarbon exploration and for this the serious geological studies and scientific approach was needed. It was this period when most of the successful studies and larger discoveries were made in Georgia.

For petroleum exploration purposes, Soviet/Russian experience was applied, as it was soon understood that geologically, Georgia, being located just south of Greater Caucasus Mountains, might have a very similar setting to well-known Russian oil fields in Northern Caucasus. Georgia is squeezed between two major orogenic systems: Greater Caucasus (which divides Georgia from Russia/North Caucasus) and Lesser Caucasus. Between those mountains, the same sedimentary formations are present which form petroleum systems of the Northern Caucasus. Recognized source rocks were the Maikop (Oligocene-Lower Miocene), and the Upper Eocene. Today, Lower Jurassic shales are being added to the source rock list. Major productive reservoir rocks are the Middle Eocene fractured volcanic tuffs, Cretaceous dolomitized limestones, and Chokrakian (Middle Miocene) and Upper Eocene sandstones.

One of the first oil fields developed by Georgian Oil was Mirzaani, which is located in the southeast region of Georgia. It was this field where the first deep (540 m) exploration well was drilled which flowed oil. In next two decades more than 200 production wells were drilled, and productive zones thickness was identified as being as much as 30-40 m. Mostly oil was produced from 500-1200 m depths and daily production varied from 4 to 100 bopd. All producing wells initially flowed oil and after the initial rate dropped, they were produced for decades by pumping. Total production from Mirzaani Field is 7.9 MMBbl.

Patara Shiraki Field is located east of the Mirzaani Field and was brought into production in 1939 from 456-800 m depths. The first well there was drilled in 1930-1932 and flowed commercial oil from 456 m depth. Most production in this field is related to two productive zones in the Upper Miocene with 1.4-3.5 and 4-26 m thickness. Total production from this field is approximately 530,000 Bbls, much smaller than Mirzaani.

Norio Oil Field ([Figure 2](#)) (northward, close to capital city Tbilisi) also was found in 1939, and Satskhenisi Field was found in 1956. These fields are characterized with high variation of initial rates, which is explained by low permeability of the reservoirs and fracture-based nature of oil flow. Total produced oil from these fields is approximately 2.1 MMBbl.

World War II stopped all exploration operations in Georgia, and most significant oil field finds made after WW II. In 1962 in Taribani (East Georgia) a 3300 m deep well initially flow of 700 bopd. More than 20 wells followed in the area and only one reached 70 bopd, with several wells 7-14 bopd, and some wells giving only oil and gas shows. Total production in Taribani is 570,000 Bbls.

In 1967 in the Teleti area (southward close to Tbilisi) at 2712 m well #11 suddenly produced a strong gas flow of 250,000 m³ per day, which was the first commercial production of gas in Georgia. However, Teleti Field production dropped very fast and it became only an oil field. Total production from Teleti Field is 3.8 MMBbl.

To date, oil had been produced only from Upper Eocene (Teleti), Oligocene (Satskhenisi), and Miocene reservoirs (Norio, Shiraki, Taribani, Mirzaani) covering central and eastern Georgia, but exploration continued for the Cretaceous which was a famous reservoir in the North Caucasus where it had produced over 2 bn bbls at a rate of 400,000 bopd.

In 1974 exploration drilling started for the Cretaceous in the Samgori-Patardzeuli area (southeast near Tbilisi), but accidentally the biggest oil field of Georgia was found in Middle Eocene fractured volcanogenic reservoirs, which had never been considered a prospective zone in Georgia. The first commercial well #7 flowed 7,000 bopd. Two hundred wells were drilled after this in Samgori-Patardzeuli, reaching a total production of 172 MMBbl. Dimensions of the field are 24 km length and 2.5 km average width. Initial production of many wells was over 3,500 bopd. Average distance between wells was 500-750 m, and the oil is a high quality (0.825 g/cm³). This field discovery brought in a huge knowledgeable technical staff from the Northern Caucasus and exploration continued mostly for the Middle Eocene throughout Georgia, however commercial discoveries in the Middle Eocene after Samgori-Patardzeuli occurred only in the South Dome Field and Teleti (south of Samgori-Patardzeuli).

After the collapse of the Soviet Union, funding of oil exploration and development ceased, followed by the civil wars in Georgia which completely ruined its oil and gas industry. From 1974-1984 in Georgia, 172 MMbbls of oil was produced from the Samgori-Patardzeuli Field, with peak production reaching 70,000 bopd.

Georgia Oil Industry Since 1994

In the early 1990's, after collapse of the Soviet Union, the territory of Georgia (including offshore) was divided into small license blocks which were taken by different junior exploration companies. Around 15 companies were license owners in Georgia in 1994. Currently nine companies are license holders under Production Sharing Agreements with the State; 90% of onshore Georgia had been licensed for petroleum operations. However, all these companies produced less than 11 MMbbls of oil from already existing fields with current daily production of around 1,000 bopd. No new commercial discoveries have been made so far.

Currently, the Georgian oil and gas industry is mainly in the exploration and redevelopment stage, and by applying modern technologies it is believed that there is real potential to increase cumulative production 10-20 times in the short to mid-term.

Today, having five oil fields and 18 sub-commercial discoveries ([Figure 4](#)), exploration of oil continues in three directions: (1) Looking for new prospective structures in already known petroleum systems, including going off-shore in the Black Sea, (2) Exploring Jurassic source rock potential, which has never been explored, yet has the excellent widespread source rock Maikop within the country, and (3) Exploring Georgia's shale oil and shale gas potential apart from the conventional potential. These directions imply wise investments in applying modern exploration (seismic, airborne gravity gradiometry and magnetic methods, geochemistry analysis) and production (horizontal drilling and multistage hydraulic fracturing) technologies.

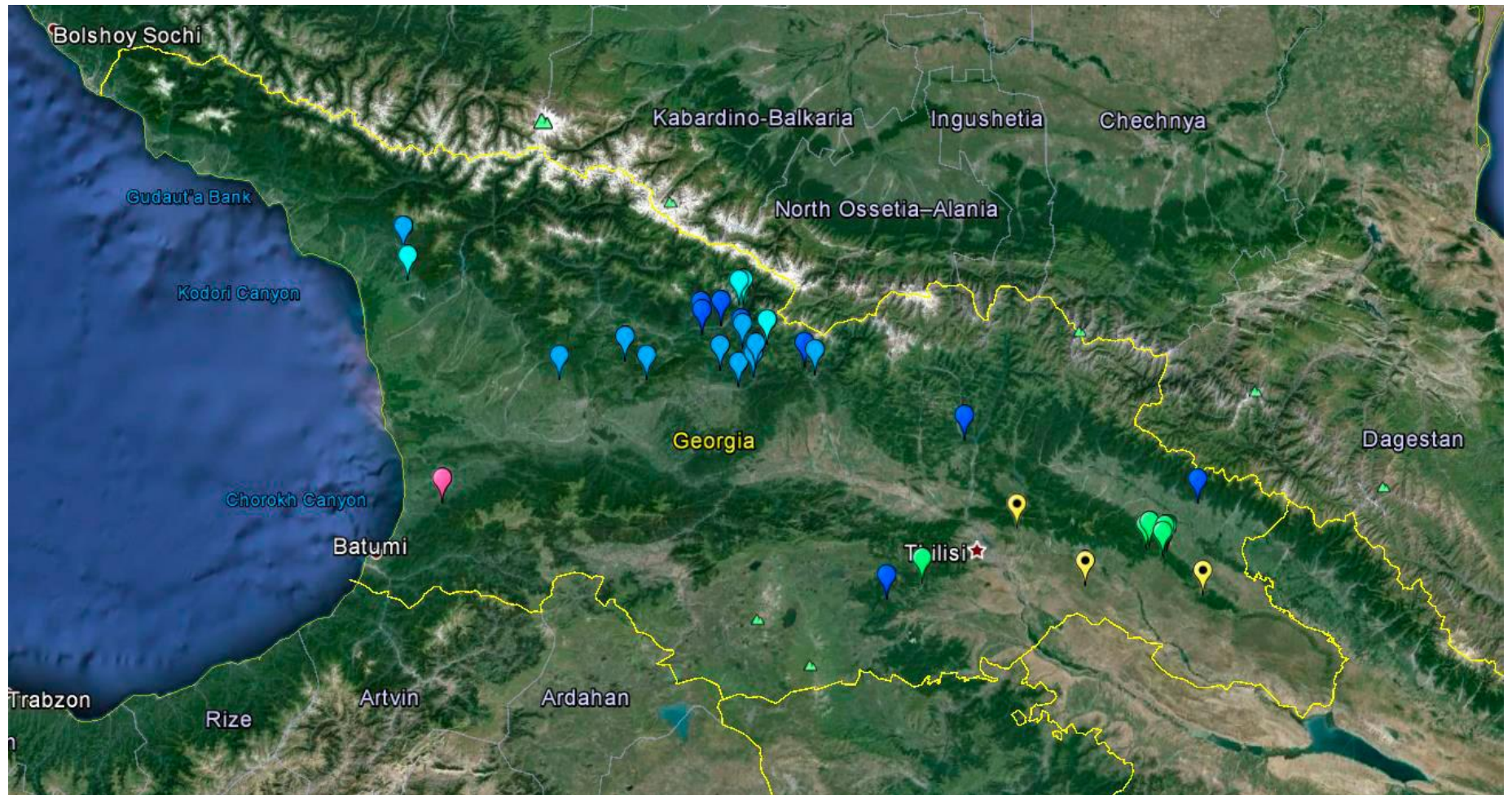


Figure 1. Surface oil shows in Georgia known from historical times as shown on satellite image.

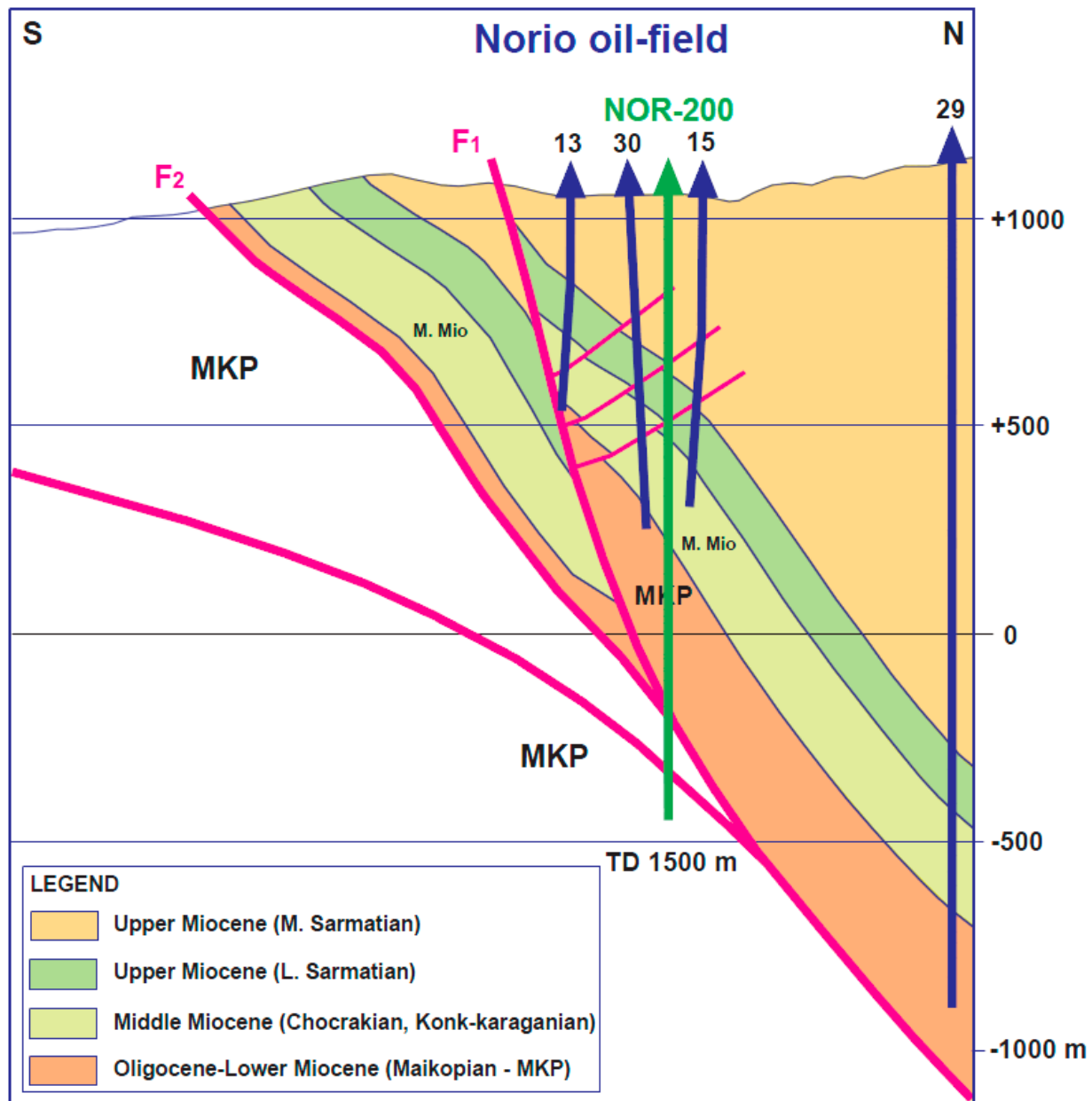


Figure 2. Geological cross section of Norio Oil Field.

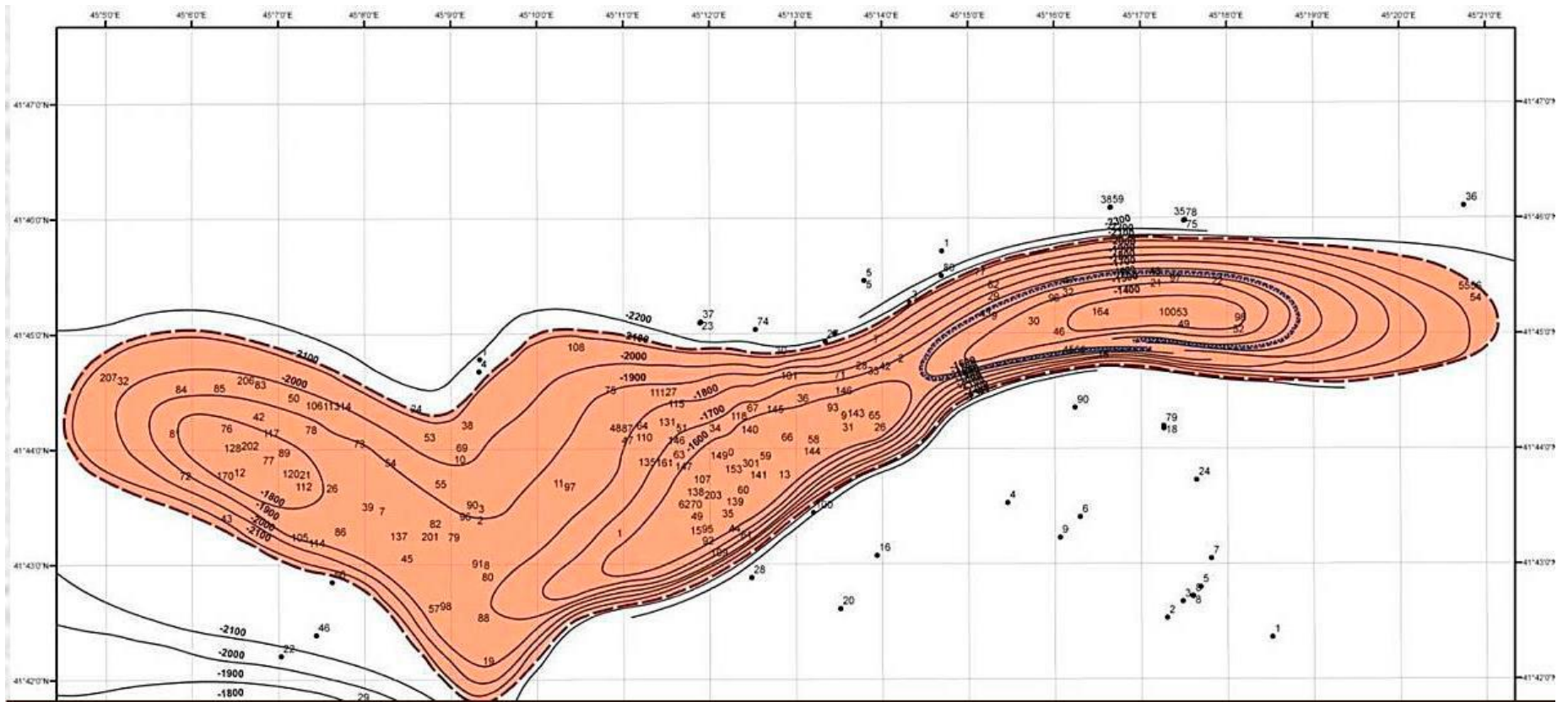


Figure 3. Samgori-Patardzeuli Field structure map.

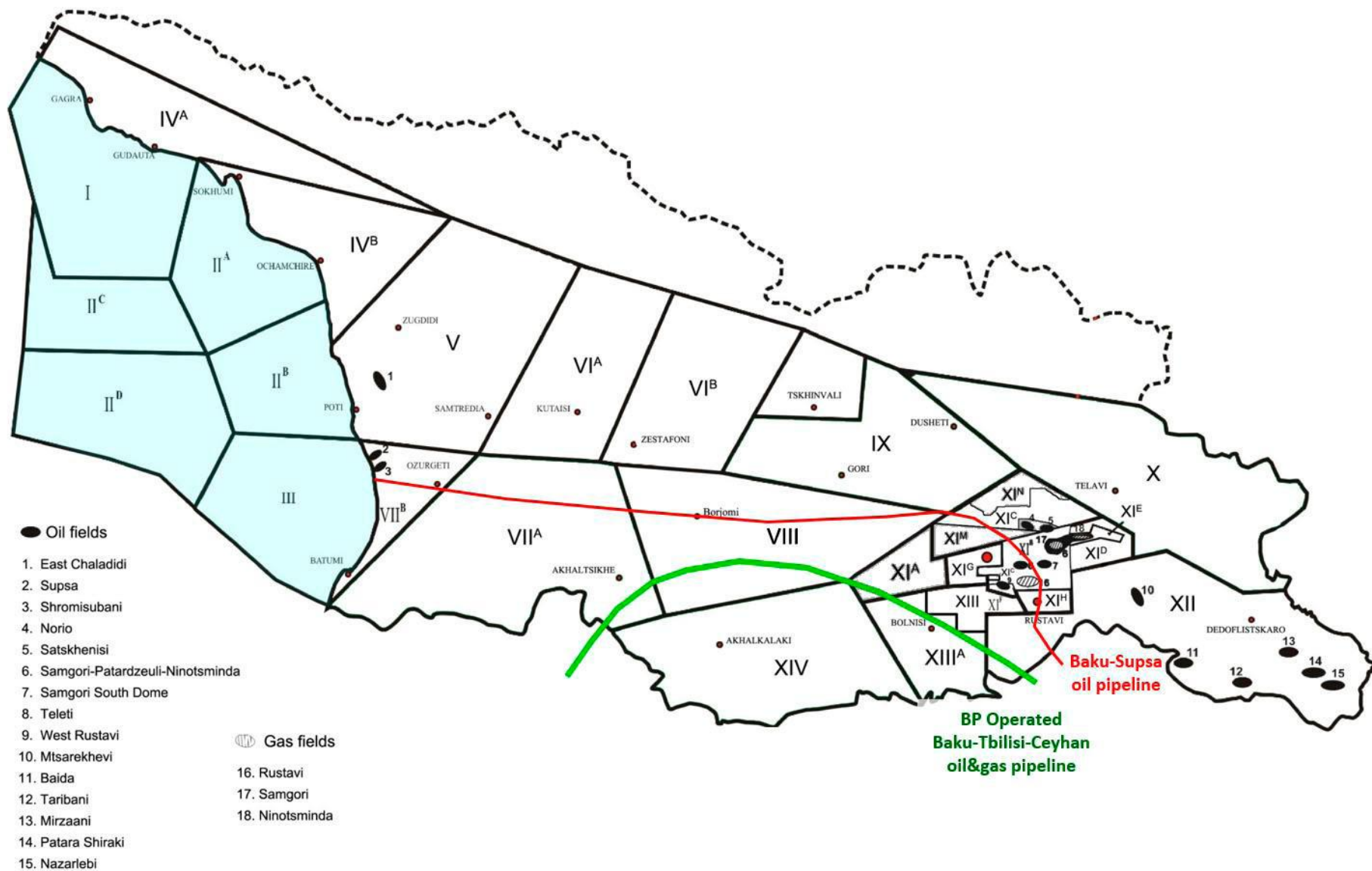


Figure 4. Current map of Georgia license blocks with existing oil fields and discoveries.