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IS THERE OIL IN GREECE? OIL EXPLORATION AND SCIENTIFIC CONFLICT DURING THE FIRST YEARS OF THE GREEK GEOLOGICAL SURVEY (1917–1925)

Christos Karampatsos, Spyros Tzokas, Giorgos Velegrakis and Gelina Harlaftis

Abstract: When Konstantinos Ktenas and Georgios Georgalas, the two most prominent interwar Greek geologists, began their respective careers around 1910, they were already enmeshed in a tense occupational and scientific conflict. The following decade, fraught with war and political upheaval, acted as a powerful "context of motivation" for their research and occupational strategies. The result was a host of scientific and institutional endeavours such as the founding of a Greek Geological Survey, the first attempts to assess the Greek lignite deposits, and involvement in consecutive oil exploration attempts that took place in Epirus between 1920 and 1937. As it turns out, the confrontational relation between the two geologists was actually productive. It signalled the emergence of a Greek geological community. It institutionalised the relations between this geological community and the Greek state. Most importantly, it produced a fusion of geological knowledge, tacit political calculation and obscure rhetoric that still remains in use to define the "reality" of the "Greek oil deposits".

This article is situated at a rather opaque historiographical crossroads. It concerns the history of geology in Greece, a matter that has rarely been treated by Greek historiography and was until recently "marginal" in the international literature of science and technology studies.[1] It also concerns the history of oil exploration,

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[1] Naomi Oreskes and James R. Fleming, "Why Geophysics?," *Studies in the History and Philosophy of Modern Physics* 31, no. 3 (2000): 255. For a recent work on the history of geology

a matter whose Greek aspect is even more rarely treated and a notorious source of "intellectual vertigo" for any historian daring to enter.[2]

This crossroads derives from the particular method we follow in order to approach the history of oil exploration in Greece. Drawing inspiration from descriptions of petroleum geology as an artisanal practice that mediates "between profit expectations, national interest and the analysis of geological structures",[3] we narrate instances of interwar oil exploration in Greece through the history of two of the major geologists involved.

The main protagonists of our story, Greek geologists Konstantinos Ktenas and Georgios Georgalas, began their respective scientific careers around 1910. The following decade was one of four consecutive wars, a doubling of Greek territory, and constant political turbulence bordering an all-out civil war.[4] It was also the decade during which oil's strategic significance became internationally apparent.[5]

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in Greece, see Christos Karampatsos, "Το γενικότερο συμφέρον του κράτους: Η 'συνέχεια των ελληνικών χωρών' και οι Έλληνες γεωλόγοι, 1908–1925," *Τα Ιστορικά* 73 (2021): 125–54. For references to Greek geologists during the turn of the century, see Christina Koulouri, *Ιστορία και Γεωγραφία στα Ελληνικά Σχολεία (1834–1914): Γνωστικό αντικείμενο και ιδεολογικές προεκτάσεις* (Athens: Istoriko Archeio Ellinikis Neolaias, 1988); Eirini Mergoupi-Savaidou, "Δημόσιος λόγος περί επιστήμης στην Ελλάδα, 1870–1900: Εκλαϊκευτικά εγχειρήματα στο Πανεπιστήμιο Αθηνών, στους πολιτιστικούς συλλόγους και στα περιοδικά" (PhD diss., National and Kapodistrian University of Athens, 2010); Leda Papastefanaki, *Η φλέβα της γης: Τα μεταλλεία της Ελλάδας, 19ος–20ος αιώνας* (Athens: Vivliorama, 2017).

[2] Hannah Appel, Arthur Mason and Michael Watts, "Introduction: Oil Talk," in *Subterranean Estates: Life Worlds of Oil and Gas*, ed. Hannah Appel, Arthur Mason and Michael Watts (Ithaca: Cornell University Press, 2015), 6. For a rare historical account of Greek oil exploration during the interwar, see Nikos Pantelakis, *Αλέξανδρος Ν. Διομήδης (1874–1950): Ένας αυθεντικός εκπρόσωπος της αστικής τάξης* (Athens: Metamesonikties Ekdoseis, 2018), 327–45.

[3] Gisa Weszkalnys, "Geology, Potentiality, Speculation: On the Indeterminacy of First Oil," *Cultural Anthropology* 30, no. 4 (2015): 625. Weszkalnys refers to the similar treatment of "metallurgy … zoology, geology, engineering, anthropology and geography," described in Andrew Barry, *Material Politics: Disputes along the Pipeline* (Oxford: Wiley Blackwell, 2013), 141–42.

[4] For an early historical account of the decade, see Georgios Ventiris, *Η Ελλάς του 1910–1920* (1931; Athens: Ikaros, 1970); a recent relevant account is George Th. Mavrogordatos, *1915: Ο Εθνικός διχασμός* (Athens: Patakis, 2015); Christos Hadziiossif and George Th. Mavrogordatos, eds., *Βενιζελισμός και αστικός εκσυγχρονισμός* (Heraklion: Crete University Press, 1988) and Douglas Dakin, *Η ενοποίηση της Ελλάδας, 1770–1923*, trans. Athanasios Xanthopoulos (Athens: National Bank of Greece Cultural Foundation, 2012), are used as works of reference.

[5] Daniel Yergin, *The Prize: The Epic Quest for Oil, Money and Power* (1991; London: Simon & Schuster, 2008), 151–67; Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil* (London: Verso, 2011), 43–65.

Motivated by this powerful context,[6] Ktenas and Georgalas were among the first Greek geologists to realise that a role of mediator between the state, the private sector and the nascent Greek geological community was possible and should be systematically pursued. The endeavours that form the bulk of our narrative, such as the founding of a Greek Geological Survey, the estimate of the Greek lignite deposits, the "geological continuity of the Greek lands" theorem, and the Epirus oil exploration attempts, were individual aspects of this wider strategy.

Given the magnitude of the stakes involved, it is not surprising that the two geologists were quickly involved in a long-standing occupational and scientific conflict.[7] At the height of the conflict, from 1918 to 1925, the Greek state had come to employ two distinct geological agencies, based in two different ministries, bearing similar jurisdictions and headed by two prominent geologists enmeshed in a veritable feud. If indeed there is a Greek history of geology "written by and for geologists",[8] the manner in which Ktenas lost control of his Greek Geological Survey between 1918 and 1924, remains one of its most repeated topics. Time and again Ktenas has been lamented as the victim of "sterile opposition" and "internal bickering" and celebrated as the "founder of geology in Greece".[9] Time and again the political aspects of the dispute have been dismissed as a predictable outcome, bound to happen whenever a pioneering scientist of "direct and morally unyielding character" like Ktenas confronted the labyrinthine internal dealings of Greek ministries and academia.[10]

Our approach arrives at a different conclusion. We argue that the conflict between the two was actually productive. It signalled the emergence of a Greek geological community. It institutionalised the relations between this geological community and the Greek state. Most importantly, it produced a Greek version

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[6] For the interplay between the specific questions posed by scientists and the wider historical context within which scientists operate, see Naomi Oreskes, "A Context of Motivation: US Navy Oceanographic Research and the Discovery of Sea-Floor Hydrothermal Vents," *Social Studies of Science* 33, no. 5 (2003): 726, 730.

[7] For the historiographical significance of technical controversies in the early Greek scientific-engineering communities, see Spyros Tzokas, "Για την κοινωνική διαμόρφωση της αναγκαιότητας της τεχνικής: Παραδείγματα από την ιστορία των Ελλήνων μηχανικών (τέλος 19ου–αρχές 20ου αιώνα)" (PhD diss., National and Kapodistrian University of Athens, 2011).

[8] Mott Greene, "History of Geology," *Osiris* 1 (1985): 97.

[9] Michail Dermitzakis, "Χαιρετιστήριος ομιλια," in *Κωνσταντίνος Α. Κτενάς (1884–1935): Το επιστημονικόν έργον και η ζωή του*, ed. Ilias Mariolopoulos (Athens: Epitropi ton eis Mnimin tou Timitikon Ekdiloseon, 1978), 27.

[10] Georges Marinos, ed., *Γεωλογία της νήσου Ικαρίας υπό Κωνστ. Α. Κτενά* (Athens: Institute for Geology and Subsurface Research, 1969), 60.

of what Gisa Weszkalnys calls "oil's magic".[11] Indeed, the fusion of geological knowledge, tacit political calculation and obscure rhetoric produced a hundred years ago still remains in use, often defining what is concerned to be the "reality" of the "Greek oil deposits".

As for the petty feud between our protagonists, its outcome is explainable. Bruno Latour has noted that in life and even more in science, "he who is able to translate others' interests into his own language carries the day".[12] Indeed, between 1912 and 1924, Ktenas and Georgalas embarked on separate quests to translate private and state interests into their own geological language. But as they found out, any "translation of interests" is de facto contingent on an even more complex prerequisite: the accurate estimation of all interests involved.

This, after all, is a story of estimates, be it of the accurate or the inaccurate kind.

Two "Fledgling Geologists" in Greece during the First Decade of the Twentieth Century

In May 1908, Konstantinos Mitsopoulos, esteemed professor of geology and mineralogy of the University of Athens, was called on to evaluate a young candidate for the position of "lecturer of petrography and mineralogy". The candidate's name was Konstantinos Ktenas. Born in 1884, Ktenas had recently returned to Greece after completing his doctoral dissertation in the University of Leipzig (1907) and a one-year internship in the Freiberg Mining Academy.[13] In addition to his notable academic credentials, Ktenas was the scion of an old financially affluent Athenian family,[14] and enjoyed the support of well-respected elder geologists such as Andreas Kordellas and Phokion Negris.[15] After

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[11] Gisa Weszkalnys, "Oil's Magic: Contestation and Materiality," in *Cultures of Energy: Power, Practices, Technologies*, ed. Sarah Strauss, Stephanie Rupp and Thomas Love (Walnut Creek: Left Coast Press, 2013), 267.

[12] Bruno Latour, "Give me a Laboratory and I will Raise the World," in *Science Observed: Perspectives on the Social Study of Science*, ed. Karin Knorr-Cetina and Michael Mulkay (New York: Sage, 1983), 144.

[13] Michail Stefanidis, *Εθνικόν και Καποδιστριακόν Πανεπιστήμιον Αθηνών: Εκατονταετηρίς, 1837–1937*, vol. 5, no. 2 (Athens: Ethniko Typografeio, 1948): 28–31.

[14] The family descended from "Panagis Ktenas who led the siege of Acropolis and conquered it as leader of the Athenians" in June 1822; see Ioannis Kandilis, "Κωνσταντίνος Α. Κτενάς. Η ζωή του, η δράσι του και η εποχή του," in *Κωνσταντίνος Α. Κτενάς (1884–1935): Το επιστημονικόν έργον και η ζωή του*, ed. Ilias Mariolopoulos (Athens: Epitropi ton eis Mnimin tou Timitikon Ekdiloseon, 1978), 46.

[15] For common publications with Kordellas and Negris just before Ktenas' appointment, see Andreas Kordellas, "Αι επωθήσεις εις την Πελοπόννησον," *Αρχιμήδης* 9, no. 8 (1908): 90–

extensively commenting on the candidate's dissertation, Mitsopoulos came to a somewhat positive conclusion:

> I therefore propose that the candidate should be appointed as a lecturer, not of petrography and mineralogy, but of mineralogy and geology or more specifically geognosy which also includes petrography, as is the chair of his Leipzig teacher, the famous professor and writer Mr. Zirkel.[16] This is because, as demonstrated by his dissertation, the young man is a fledgling geologist and because petrography should not be deemed to be a luxury in our university.[17]

This complicated paragraph can serve as a dense summary of the problems faced by Greek "fledgling geologists" at the time. The problems started with the status of their discipline. Indeed, what is nowadays called earth sciences did not yet exist as a well-defined field of scientific inquiry.[18] Mitsopoulos confidently recited relevant subfields, but the use of such terms actually indicated more a "desire to designate new fields" than "success in doing so",[19] and earth sciences did not acquire a unifying theory until the development of plate tectonics in the 1960s.[20] In addition, earth sciences, however meticulously defined, were constantly suspected

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93; Ph. Negris and Const. Ktenas, "Sur le Néocrétacé de l'Argolide," Les Comptes Rendus de l'Académie des Sciences de Paris 145 (1907): 1235. Negris "who respected and loved [Ktenas] very much" was one of the few who "visited [Ktenas] regularly … and were accepted inside his private office"; Kandilis, "Κωνσταντίνος Κτενάς," 56.

[16] In later writings, Ktenas also mentions Hermann Credner as his teacher; see Konstantinos Ktenas, *Η γεωλογική υπηρεσία της Ελλάδος: Προμελέτη δια την ίδρυσιν και οργάνωσίν της* (Athens: Ministry of National Economy, 1917): 26.

[17] "Συνεδρίαση 12 Μαΐου 1908," in *Πρακτικά Συνεδριάσεων της Φυσικομαθηματικής Σχολής 1904–1911*, vol. 2, accessed 31 July 2020, https://pergamos.lib.uoa.gr/uoa/dl/object/52255. Emphasis in original.

[18] Ronald Doel, "The Earth Sciences and Geophysics," in *Science in the Twentieth Century*, ed. John Krige and Dominique Pestre (Amsterdam: Harwood, 1997): 391.

[19] Gregory Good, "The Assembly of Geophysics: Scientific Disciplines as Frameworks of Consensus," *Studies in the History and Philosophy of Modern Physics* 31, no. 3 (2000): 280. For example, usage of the term "geognosy" had been declining since 1820, although it "took a long time to die out"; Richard Howarth, "Etymology in the Earth Sciences: From 'Geologia' to 'Geoscience'," *Earth Sciences History* 39, no. 1 (2020): 9. The rector's office was very well able to confuse "geology" (*γεωλογία*) with "agriculture" (*γεωργία*) in its official correspondence, much to Mitsopoulos' frustration; see Archives of the Museum of Mineralogy and Petrology of the University of Athens (APOP), folder 1905–1906, "Πρυτανεία προς Μητσόπουλο," 17 May 1906, with Mitsopoulos' handwritten notes.

[20] Naomi Oreskes, "From Continental Drift to Plate Tectonics," in *Plate Tectonics: An Insider's History of the Modern Theory of the Earth*, ed. Naomi Oreskes and Homer Le Grand (London: CRC, 2018), xi, 27.

of lacking a "practical application", a reputation that was rather well-deserved, given the dominant mentality among prominent geologists of the time.[21]

The second kind of problem was of a more obscure nature, related as it was to the occupational environment and its byzantine politics. In 1906, the university's Mineralogical Museum, directed by Mitsopoulos since 1895, was split into two. The new separated half of the institution was named the Geological and Paleontological Museum and its direction was passed on to Theodoros Skoufos, who until then had served under Mitsopoulos as the museum's prefect, but was now promoted to tenured professor of "Geology and Palaeontology".[22] The division led to constant bickering concerning the ownership and management of the museum's library, scientific instruments, halls and budget.[23] In other words, Mitsopoulos already had ample reasons to suspect that his position within the university was in jeopardy. The demeaning word "fledgling" was underlined in the proceedings, a permanent reminder that he weighed the young man's academic credentials and social connections, and found the result to be particularly unsettling.

Georgios Georgalas, one of Mitsopoulos' most promising doctoral students, had even more reasons to be unsettled. Born in 1887 (thus three years younger than Ktenas), Georgalas conducted his dissertation entirely in the University of Athens. The lack of studies abroad leads us to suspect that he was less affluent than Ktenas, and so does the fact that initially he had to be unofficially supported by the mineralogical museum's contract work.[24] Since 1906 however, his

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[21] Paul Lucier, "A Plea for Applied Geology," *History of Science* 32 (1999): 284.

[22] Kostas Gavroglu, Vangelis Karamanolakis and Chaido Barkoula, *Το Πανεπιστήμιο Αθηνών και η ιστορία του* (Heraklion: Crete University Press, 2014), 293.

[23] Mitsopoulos laments the loss of "more than half of the budget" in APOP, folder 1906–1907, "Επιστολή από Μητσόπουλο προς Γερμανό," n.d.; for the library see Mitsopoulos' underlines in APOP, folder 1907–1908, "Πρακτικόν," 19 June 1908; for the instruments, see APOP, folder 1907–1908, "Επιστολή από Μητσόπουλο προς Σκούφο," 17 June 1908; for complaints on the students who "entered and exited Mr. Skoufos' classes" by trespassing through Mitsopoulos' territory, see APOP, folder 1907–1908, "Προς τον αρχιτέκτονα του Εθν. Πανεπιστημίου," 24 June 1908.

[24] In December 1904, Georgalas presented in the paperwork as an independent "naturalist", was paid 500 drachmas for the delivery of "six geological and mineralogical tables" to the museum; this was a substantial sum amounting to more than six monthly salaries of a museum assistant; see APOP, "Κατάστασις Εξόδων του Φυσιογραφικού Μουσείου," folder 1904–1905, 14 December 1904. There were other transactions of this kind in the next two years; see APOP, "Κατάστασις Εξόδων του Φυσιογραφικού Μουσείου," folder 1904–1906, 24 February 1905; also APOP, "Απόδειξις δρχ. 108," folder 1906–1907, 1 November 1906. During the same period, Georgalas conducted "over 300 experiments" of quantitative analysis of asphalt under the guidance of his "lamented teacher K. Mitsopoulos"; Georgios

dissertation was funded by a periodically renewed yearly scholarship, as well as the salary of "assistant prefect of Mineralogy, Geology and Physics" in the School of Industrial Arts, of which Mitsopoulos was director.[25] Georgalas completed his dissertation in 1909; under different circumstances he could have reasonably hoped that he would be the one to succeed Mitsopoulos.[26]

Things did not work out as expected. Ktenas used the four years following his appointment as lecturer to successfully compete with all the typical problems faced by geologists of the time. His success as a teacher was probably reflected in the plummeting attendance at Mitsopoulos' classes, observed since 1908.[27] His 1910 treatise on the nomenclature of Greek minerals managed an admirable balance between the "state of confusion" characteristic of international petrographical nomenclature[28] and the Greek tendency to validate mineral names only when they derived from "the ancient Greeks".[29] His connections with venerable earth science pioneers Kordellas and Negris were put to good use and he was readily accepted as one of the 170 members

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Georgalas, "Αι εν Ελλάδι εμφανίσεις ορυκτών υδρογονανθράκων," in *Επιτροπή επί των καυσίμων: Πορίσματα, εκθέσεις και υπομνήματα του μεταλλευτικού τμήματος αυτής*, ed. Georgios Georgalas (Athens: Ministry of National Economy, 1920), 89.

[25] Georgalas' scholarship expired in December 1906 and was renewed in October 1907; see "Συνεδρίαση 8 Οκτωβρίου 1907," in *Πρακτικά Συνεδριάσεων της Φυσικομαθηματικής Σχολής 1904–1911*, vol. 2, accessed 31 July 2020, https://pergamos.lib.uoa.gr/uoa/dl/object/52255. Stefanidis, *Εθνικόν και Καποδιστριακόν*, 67–68.

[26] Stefanidis, *Εθνικόν και Καποδιστριακόν*, 67, states that Georgalas completed his dissertation in 1907. Georgalas himself states that his dissertation was completed in 1909; see Georgios Georgalas, "Η του Ακροκορίνθου Περιοχή Γεωλογικώς Εξεταζομένη," *Αρχιμήδης* 12, no. 2 (1912): 116. The most probable date is 1909 since even then Georgalas was only 22 years old.

[27] In September 1908 Mitsopoulos suspected that the rector's office was somehow related to the plummeting attendance of his classes ("eight students instead of the usual 100") and was compiling letters of protest to the rector; APOP, folder 1908–1909, "Μητσόπουλος προς Πρυτανεία," 30 September 1908.

[28] Davis Young, "Origin of the American Quantitative Igneous Rock Classification: Part 2," *Earth Sciences History* 28, no. 2 (2009): 180.

[29] Ktenas justified his adherence to international nomenclature with a short self-contradictory phrase: "even when the name was erroneous (not deriving from the "ancients") it was transferred as is"; Konstantinos Ktenas, *Ορυκτογνωστικοί πίνακες μετά καταλόγου των εν Ελλάδι ορυκτών και των παραγενετικών των συνθηκών* (Athens: Typ. Sakellariou, 1910), 4. The book replaced the one by Mitsopoulos and remained in use for more than a decade. From the late nineteenth century, Greek engineers often justified their modern engineering projects by emphasizing a supposed continuity with Greece's ancient engineering past; see Spyros Tzokas, "Greek Engineers, Institutions, Periodicals and Ideology: Late 19th and Early 20th Century," *History and Technology* (2017): 157–78.

of the Greek Polytechnic Association.[30] Even geology's ill-reputed "lack of practical applications" soon proved to be irrelevant for someone educated at the Freiberg Mining Academy.[31] Ktenas soon began participating in state-funded mine studies and acquainting himself with other fledgling members of the Greek geological community.[32]

Georgalas did not fare as well. His 1909 dissertation treated the stratigraphy of his native Akrokorinthos area in the Peloponnese, but somehow Ktenas and Negris began exploring the exact same area and published their research before him in the prestigious bulletin of the French Geological Society.[33] In 1912, when the 25-year-old Georgalas tried to publish a summary of his dissertation in the *Αρχιμήδης* journal, his piece immediately elicited a response from none other that the 66-year-old Negris.[34] Phrases like "as demonstrated by G. Georgalas and K.A. Lacroix before him (Compte Rendu de l'Académie, 26 Décembre 1898)" walked a fine line between accusing him of incompetence and of plagiarism.[35]

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[30] Ελληνικός Πολυτεχνικός Σύλλογος. "Τακτικά μέλη," *Αρχιμήδης 10*, February appendix (1909): 12.

[31] For the Frieberg Mining Academy and the efforts therein to develop systematic knowledge out of the miners' tacit knowledge, see Warren Dym, "Scholars and Miners: Dowsing and the Freiberg Mining Academy," *Technology and Culture* 49, no. 4 (2008). For Freiberg as a breeding ground of Greek mining engineers, see Papastefanaki, *Η φλέβα*, 309–14. For Ktenas' teachers, Ferdinand Zirkel and Hermann Credner, as pioneering "practical geologists," see Lucier, "A Plea," 298–300, and Young, "Igneous Rock Classification," 175–203.

[32] In 1909, Ktenas participated in a study of the Halara mine of Serifos island. The resulting study is cited in many of Ktenas' works as Konstantinos Ktenas, Ilias Gounaris and Alexandros Papamarkou, *Το μεταλλείον "Ακρωτήριον Χάλαρα" και η προς αυτό συνεχομένη απαραχώρητος έκτασις της νήσου Σερίφου (Μελέτη Γενομένη Εντολή της Ελληνικής Κυβερνήσεως)* (Athens: 1910). We were unable to locate this study; Negris, however, ended up holding 5 percent of the Halara mine's stock "as a right of discovery"; see APOP, "Φωκίωνας Νέγρης, Η διαθήκη μου," folder 1925, 7 February 1928. Ktenas' co-writers, Gounaris and Papamarkou were of roughly the same age as Ktenas; at the time they were also beginning their respective careers in the Mining Department of the Ministry of National Economy; see Papastefanaki, *Η φλέβα*, 154–55, 312.

[33] Phokion Negris and Konstantinos Ktenas, "Sur l'âge triasique du calcaire de l'Acrocorinthe," *Bulletin de la Société Géologique de France* 10 (1910): 311.

[34] At the time Negris had served as the mayor of the mining city of Lavrion, a Member of Parliament and twice minister of finance; Giorgos Peppas, *Φωκίων Νέγρης, 1846–1928* (Athens: Tsoukatou, 2011): 125–64. For the significance of the *Αρχιμήδης* journal, see Tzokas, "Greek Engineers," 164–65.

[35] Georgios Georgalas, "Η του Ακροκορίνθου"; Phokion Negris, "Η Ακροκόρινθος και τα πέριξ αυτής μέρη γεωλογικώς εξεταζόμενα," *Αρχιμήδης* 13, no. 5 (1912): 55.

The stakes were not exclusively scientific. The "Goudi Coup", a 1909 radical restructuring of the political system fuelled by popular protest, had already led to the dismissal of several university professors. Undoubtedly owing to the "intrauniversity conflicts" we have already described, Mitsopoulos had already been dismissed from the university in July 1910, and was temporarily replaced by his former subordinate Skoufos.[36] In February 1912, a "special university committee" that included Skoufos promoted Ktenas to a tenured professor of mineralogy and petrography of the University of Athens and director of the university's Mineralogical Museum.[37] As far as we know, Georgalas did not bother to apply for the chair; his 1912 appointment to the position of prefect of the university's Geological and Paleontological Museum, under his "respected teacher Theodoros Skoufos",[38] can be interpreted as a reward for his tacit acceptance of his position within the academic hierarchy.

In 1912, Ktenas and Georgalas, neither of whom had yet reached the age of 30, could rightfully be counted among the most promising young geologists in Greece. They had tested their ability to navigate between scientific problems, practical applications and occupational disputes. And they had begun establishing their position within the academic hierarchy, basing themselves in two spatially adjacent museums of the same university. Meanwhile the country was heading towards the Balkan Wars. The settlement proved to be temporary.

A Geologist Matures During a "Civilising Mission": Ktenas and the Idea of a Greek Geological Survey

One of the major strategic tasks undertaken since the initial founding of the Greek nation-state was the "unification of the territory and homogenisation

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[36] Gavroglu, Karamanolakis and Barkoula, *Το Πανεπιστήμιο*, 198. For a recent account of the "Goudi Coup," see Nikos Potamianos, "Populism in Greece? Right, Left, and Laclau's 'Jacobinism' in the Years of the Goudi Coup, 1908–1910," *Journal for the Study of Radicalism* 14, no. 2 (2020): 127–55.

[37] For Ktenas' appointment, see "Συνεδρίαση 1 Φεβρουαρίου 1912," in *Πρακτικά Συνεδριάσεων Φυσικομαθηματικής Σχολής 1911–1917*, vol. 3, 15, accessed 5 August 2020, https://pergamos.lib.uoa.gr/uoa/dl/object/53483. For the involvement of Theodoros Skoufos, see Ioannis Kandilis, *Οι Θεμελιωταί των Φυσικών Επιστημών στη Νεώτερη Ελλάδα και η Εποχή τους* (Athens: s.n., 1976), 105.

[38] Stefanidis, *Εθνικόν και Καποδιστριακόν*, 67. In his later writings, Georgalas always remembered to express his gratitude towards Skoufos; see Georgios Georgalas, ed., *Ίδρυσις και πεπραγμένα του γεωλογικού γραφείου μέχρι τέλους του 1920* (Athens: Ministry of National Economy, 1921), 8.

of the population",[39] or, to put it in Maria Synarelli's words, "the conquest of the national space".[40] The Balkan Wars conducted against the Ottoman Empire and Bulgaria between 1912 and 1913 can be regarded as a relevant milestone. The "New Lands" acquired in 1913 had to be "conquered" anew in Synarelli's sense of the word; this was a "conquest" of a technopolitical nature involving "a purposeful state intervention of unprecedented scale, the cornerstone of which was the regulation of space".[41] Dimitrios Diamantidis, an engineer and a founding member of the Greek Polytechnic Association who became the first minister of transport in 1914,[42] summarised this task as a "civilising mission" that would involve "all those serving the physical sciences".[43]

Diamantidis' tempting message resonated among "those serving the physical sciences" long before he gave his speech. To take a familiar example, Ktenas was synchronising himself with the "civilising mission" since 1912. Immediately after his appointment he began staffing the museum with people of his choice,[44] purchasing the scientific instruments required in order to transform it into a proper scientific laboratory[45] and cataloguing its vast mineral collections.[46] The research conducted from this increasingly sophisticated base was immediately

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[39] Christos Hadziiossif, "Εισαγωγή," in *Ιστορία της Ελλάδας στον 20ο Αιώνα*, vol. A1, ed. Christos Hadziiossif (Athens: Vivliorama, 2002): 11.

[40] Maria Synarelli, *Δρόμοι και λιμάνια στην Ελλάδα* (Athens: Politistiko kai Tehnologiko Idryma ETVA, 1989):52.

[41] Nikos Kalogirou, "Η Γεωγραφία του εκσυγχρονισμού: Μετασχηματισμοί του ελλαδικού χώρου στον μεσοπόλεμο," in Hadziiossif and Mavrogordatos, *Βενιζελισμός και αστικός εκσυγχρονισμός*, 91.

[42] Tzokas, "Greek Engineers," 166.

[43] "Ο υπουργός της συγκοινωνίας και ο πολυτεχνικός σύλλογος," *Αρχιμήδης* 15, no. 6 (1914): 61–63.

[44] Such was the case of "trusted artisan Vasilios Bravakos", who replaced the museum's previous clerk and remained "the only one with the right to backtalk to Ktenas" until Ktenas' death in 1935. See APOP, "Κτενάς προς Πρυτανεία," folder 1911–1912, 12 June 1912. On the relation of the two men, see Kandilis, *Οι Θεμελιωταί*, 104–105.

[45] Purchases included a petrographic microscope, as well as photographic equipment; the equipment was used to examine "microscopic samples" constructed by the dozens by "Voigt and Hochgesang of Göttingen, Germany". The upgrade of the museum's equipment is evident in the spectacularly modern illustration that begun accompanying the scientific articles produced; for the microscope see APOP, "Petrographisches Mikroskop," folder 1912-1914, n.d.; for the photographic equipment see APOP, "Κτενάς προς πρυτανεία," folder 1912–1914, 5 September 1913; for the "microscopic samples" see APOP, "Κτενάς προς πρυτανεία," 9 November 1913.

[46] Cataloguing the museum's collection required the construction of more than 10,000 boxes, hundreds of wood pedestals, dozens of showcases and provided a constant occupation for the museum's staff for more than 10 years; see for example APOP, "Κτενάς

oriented towards the "New Lands". The first scientific expedition organised by the laboratory was conducted in Crete, even before it was officially annexed.[47] Ktenas somehow managed to transform his October 1912 military draft into a one-person geological trip in the "New Lands". By January 1913, with the war still ongoing, he was contributing to the daily press under the general heading "The Exploitation of New Greece", taking care to denote that his submissions originated from areas such as "Kastoria" and "Strevini", unknown corners of "New Greece" that were "never before submitted to scientific exploitation".[48] The first maps to arrive in the museum from abroad as soon as circumstances allowed it, depicted more of these areas: "Saloniki, Vodina, Monastiri, Janina, Halkidiki, Athos, Kavala".[49]

This fervent activity immediately began providing for two intertwined scientific projects, both of which were carefully aligned with Diamantidis' "civilising mission". The first project concerned a theorem that would briefly be known as "the geological continuity of the Greek Lands". This involved the use of stratigraphic methods in order to prove that the lands between the island of Corfu and Western Asia Minor were in fact part of a single "geological unit".[50] The second project concerned the founding of a Greek Geological Survey, an endeavour of even larger scale and ambition. First proposed by Greek geologists in 1893,[51] the survey would conduct government-subsidised subsoil exploration and produce a "comprehensive geological map" of the whole of the territory. As in foreign examples, the geological survey would serve to align the interests of

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προς Πρυτανεία," folder 1912–1914, 7 February 1912; APOP, "Κτενάς προς Πρυτανεία," folder 1912–1914, 27 June 1914.

[47] APOP, "Κτενάς προς Πρυτανεία," folder 1912–1914, 8 September 1912.

[48] Konstantinos Ktenas, "Η εκμετάλλευσις της Νέας Ελλάδος," *Εστία*, 30 January 1913; Ktenas, "Η εκμετάλλευσις της Νέας Ελλάδος," *Εστία*, 16 February 1913. Strevini is probably the town of Strevina in Arta, renamed Kampi in 1927.

[49] APOP, "Πληρωμή Ελευθερουδάκη και Μπαρτ," folder 1914–1915, 3 October 1914. Vodina has been renamed Edessa.

[50] Ktenas partook of relevant ideas expressed by German geologists, such as Leopold von Buch and Alfred Philippson; see Leopold von Buch, "Φυσικοϊστορική περιγραφή νήσων του Αρχιπελάγους εν Ελλάδι," *Αρχιμήδης* 15, no. 7 (1914): 78; also Alfred Philippson, "La Tectonique de l'Égéide (Grèce, Mer Egée, Asie Mineure Occidentale)," *Annales de Géographie* 7, no. 32 (1898): 112. This complex story has been narrated elsewhere; see Karampatsos, "Το γενικότερο συμφέρον του κράτους," 138–42, 149.

[51] "Let us hope that the government will found a geological institution (Geologische Anstalt) through which young Greek geologists will explore the qualities of the Greek soil inch by inch"; Konstantinos Mitsopoulos, *Στοιχεία γεωλογίας* (Athens: Typ. Anesti Konstantinidou, 1893), 591–92.

"capitalists, geologists and the state alike",[52] a function obviously suited to the demands posed by any significant territorial expansion.[53]

Ktenas spent the period from 1914 and 1917 engrossed in his two projects. Beginning on 13 December 1913,[54] he initiated extensive correspondence with the directors of various European geological surveys, such as esteemed professor Ludovic Mrazek of the Romanian Survey.[55] In 1914, he used his museum's budget to organise a geological expedition at the newly annexed island of Chios and immediately began processing the minerals recovered using his new state-of-the-art equipment. In 1915 he used the newly organised collections of his museum in order to begin suggesting the existence of a "geological link between Greece and Asia Minor" via the islands of Limnos and Imvros and the Gallipoli Peninsula.[56] In 1916, his first doctoral student, Maximos Maravelakis, completed

[52] Lucier, "A Plea," 287.

[53] The founding of a national geological survey often coincides with the rise and consolidation of a corresponding modern nation state. For example, the Prussian Geological Survey was founded in 1873; see Martin Guntau, "The History of the Origins of the Prussian Geological Survey in Berlin, 1873," *History and Technology* 5, no. 1 (1988): 51–58. The Portuguese Geological Survey was founded in 1857; see Teresa Salomé Mota, "Spending Some Time in the Field: Fieldwork in the Portuguese Geological Survey during the Twentieth Century," *Earth Sciences History* 33, no. 2 (2014): 201. The Italian Geological Survey was founded between 1861 and 1867; see Pietro Corsi, "Much Ado about Nothing: The Italian Geological Survey, 1861–2006," *Earth Sciences History* 26, no. 1 (2007): 102–4. In the US, state-funded geological surveys began emerging as early as 1830; see Walter Hendrickson, "Nineteenth-Century State Geological Surveys: Early Government Support of Science," *Isis* 52, no. 3 (1961): 359.

[54] See APOP, "Der director der Konigl. Geologischen Landesanstalt an Herrn Professor Dr. A. Ktenas," folder προμελέτη, 23 January 1914. Regrettably, a large part of the relevant correspondence has been lost, as demonstrated by an index contained in the relevant folder. However the folder remains a testament to Ktenas' methodical approach and the particular significance he attributed to the matter.

[55] Other correspondents included Franz Beyschlag of the Prussian Survey and Bernardino Lotti of the Italian Survey. A "committee for the organisation of a Geological Survey in Greece" briefly existed inside the Bavarian survey, thus director Ludwig von Ammon and his successor Otto Reis were especially helpful, extensively describing their survey's facilities and project costs and providing extensive map samples. The committee was abandoned in the following years and is not mentioned in Ktenas' published final study, a fact that can be attributed to the outbreak of the First World War; see APOP, "Die Commission zur Organization einer geologischen Landesuntersuchung in Griechenland a. H. des Herrn Professor Dr. Konst. A. Ktenas," folder προμελέτη, 8 March 1914.

[56] Konstantinos Ktenas, "Ανεύρεσις ηωκαίνου στρώματος και εκρήξεως μικρογανουλίτου εις την Νήσον Ίμβρον," *Επετηρίς του Εθνικού Πανεπιστημίου* 9 (1915): 4.

his dissertation, disproving the existence of anthracite in Chios and suggesting that the "geotectonic structure of the island" extended "opposite Chios to the Erythrae Peninsula".[57] In 1916 Ktenas managed to arrange a visit "to the facilities of the Italian geological survey", followed by a trip to Switzerland.[58]

Meanwhile, Greek history was running its turbulent course. Beginning in 1915, the issue of Greece's participation in the First World War became heavily contested, leading to an unprecedented polarisation of the political system, bordering on all-out civil war. In June 1917 the pro-German King Constantine was deposed and Greece officially entered the war on the side of the Entente. The proponents of neutrality were submitted to severe persecution.[59] Among those persecuted was professor of geology and palaeontology Theodoros Skoufos, who was dismissed from the university in November 1917, along with several other professors.[60]

Ktenas fared much better. Between 1914 and 1917 he forwarded his proposal for a Greek Geological Survey to the endless succession of ministers in the Ministry of National Economy, where his plans allegedly were met with approval.[61] In the early 1917 he went on to publish two extensive articles that jointly described his ambitious institutional and scientific programme.

The first article, "The Anthracites of Greece", was presented as a treatise on the possible existence of Greek anthracite deposits that could be used instead of the country's lignite deposits. In fact it was a display of a general scientific methodology designed to produce subsoil knowledge via stratigraphic methods. According to Ktenas, the anthracite deposits could only be found "in the Paleozoic strata and more specifically in the formations of the Carboniferous period". Thus, in order to adjudicate on the existence of anthracite, "one needs only seek the Paleozoic and more specifically the Carboniferous strata". In this way "the search for anthracite [was] transformed into a matter of a purely theoretical nature".[62] He then combined his own stratigraphic observations in Chios and Attica with those of Friedrich Teller, Jacques Deprat, Carl Renz and Alfred Philippson in order to demonstrate

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[57] Maximos Maravelakis, "Οι Εκρηξιγενείς Σχηματισμοί και η Μεταλλογένεια της Νήσου Χίου, Μέρος Β," *Αρχιμήδης* 17, no. 2 (1916): 18.

[58] Ktenas, *Προμελέτη*, iv–v.

[59] Dakin, *Η ενοποίηση της Ελλάδας*, 303–32.

[60] Gavroglu, Karamanolakis and Barkoula, *Το Πανεπιστήμιο*, 208.

[61] Ktenas, *Προμελέτη*, iv–v. The "approval" remained oral as far as we know. The "expert scientists supporting the creation of the survey" included all of Ktenas' connections in the scientific community mentioned in the previous section, such as "Messrs. Ph. Negris, P. Protopapadakis, Th. Skoufos, S. Papavasiliou, I. Gounaris and A. Papamarkou".

[62] Konstantinos Ktenas, "Οι λιθανθρακες της Ελλάδας, μέρος Α΄," *Αρχιμήδης* 18, no. 1 (1917): 2–3.

the existence of "Paleozoic strata" that continuously extended from Attica to western Asia Minor. He took care to denote that this conclusion contradicted all earlier "deeply rooted ideas" concerning the Greek territory, and left the "geological continuity" lingering in the form of a map (fig. 1). From a purely "economical" viewpoint, this demonstration of methodological vigour led to a negative conclusion: "we cannot hope for the existence of significant anthracite deposits within the Greek Lands".[63] From a more strategic viewpoint, however, the result was most promising. It demonstrated a new method for accumulating subsoil knowledge. The implied message resounded clearly: undervalued "geological theories" were after all of great importance and could be put to immediate practical use.

The "Preliminary Study on the founding and organisation of a Greek Geological Survey" was published a few months later, in July 1917. Ktenas proposed the initiation of a "systematic geological exploration of the Greek Lands". This would be a project of unprecedented scale and multifaceted value, a veritable state asset. On

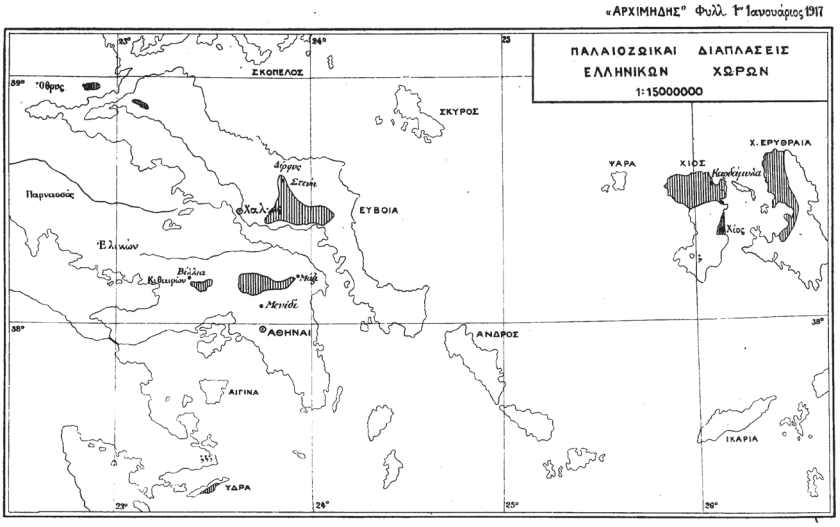

Figure 1. The stratigraphic synthesis achieved in "The Anthracites of Greece" was summarised in a map titled "The Paleozoic formations of the Greek Lands". The map also tacitly implied the "geological continuity" between recently conquered and soon-to-be-conquered territories. The island of Chios, geologically examined as early as 1914, lies to the east, opposite the Erythrae Peninsula. (Konstantinos Ktenas, "Οι λιθανθρακες της Ελλάδας, μέρος Α΄," *Αρχιμήδης* 18, no. 1 [1917]: 4.)

[63] Konstantinos Ktenas, "Οι λιθανθρακες της Ελλάδας, μέρος Β΄," *Αρχιμήδης* 18, no. 2 (1917): 14.

the one hand it would solve "geological problems" such as "uncovering the existent relations" between "the geological strata of Greece and those of Asia Minor".[64] On the other it would contribute to sectors of the national economy as varied as "agriculture, mining, tunnel, road and railroad construction … which should operate inextricably connected to the Geological Survey".[65] In summary, Ktenas' survey was meant to become "the main node of control and scientific direction of all wealth-creating sectors of [the] country".[66] Ktenas precisely calculated the project's timeline: "in order to conclude the detailed geological exploration of the Greek Lands we need 456 years; therefore, a staff of 10 geologists will be able to complete the task in 45 to 50 years at a minimum".[67]

The two articles were designed to jointly emit a powerful message. A method for accumulating subsoil knowledge had been developed and implemented in "The Anthracites of Greece". It stemmed from geological "theory", yet it was powerful enough "to let us traverse the carboniferous strata in their entire length, depth and width", political enough to align itself with the national interest and accurate enough to provide conclusive answers to the most urgent practical questions. This method would be organised in the form of a state agency and provide "a node of scientific direction" for all national industrial activity. In the middle of this war decade, Ktenas could imagine himself as the principal figure in a nursery for future Greek geologists, as the one to mediate between the geological community, private industry and the state, for five decades "at a minimum".

At the same time, he was hardly indifferent to short-term gains. As he noted in the final pages of his "Preliminary Study", "the University already possesses a mineralogical laboratory as well as a paleontological one. In order to minimise costs, those laboratories and the attached museums … could serve to accommodate the operation of the geological survey", of course after the resolution of all "relevant matters of an administrative nature".[68] Ktenas was trying to exploit Skoufos' imminent dismissal from the university in order to unify the institution's two separate geological museums under his direction.

Ktenas was obviously in the midst of translating Diamantidis' "civilising mission" into his own geological language. Yet, as it turned out, the prefect of the Paleontological Museum and former antagonist, Georgios Georgalas, had a strong say in the matter.

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[64] Ktenas, *Προμελέτη*, 9.

[65] Ibid., 8.

[66] Ibid., 8.

[67] Ibid., 55.

[68] Ibid., 60.

The Founding of the Greek Geological survey(s), or How to Efficiently Assess Lignite Deposits

Georgios Georgalas' career trajectory until 1917 is much harder to trace. As we have seen, he acquired the position of prefect of the university's Paleontological Museum under Skoufos in 1912, at the same time that Ktenas acquired his tenure. We know that in 1916 he was promoted to "professor of physics in the appended schools of the Technical University", where Skoufos had replaced Mitsopoulos after 1911, and that he retained the position at least until 1919.[69] There is archival evidence that Georgalas initially accepted his position within the academic hierarchy and even tried to make amends with Ktenas and Negris, probably to little avail.[70] However, the events of 1917 indicate a sharp turning point in Georgalas' attitude and career choices. This is hardly surprising; as we have seen, Skoufos was dismissed from the university and Ktenas was trying to exploit the opportunity in order to reunite the two museums under his direction. If this came to be, Georgalas would remain his subordinate for the foreseeable future.

For the time being, however, things were going as planned for Ktenas. Although he failed to officially unite the two museums, he was appointed temporary director of the Paleontological Museum after Skoufos' dismissal from the university. Skoufos never forgave this blatant display of ingratitude, but at least initially, it seemed to pay off.[71] In August 1917, a "mining laboratory" was founded in the Ministry of National Economy. The relevant law specifically stated that the "mining laboratory" would be "attached to the mineralogical and petrographical laboratory of the University and directed by the tenured Professor of Mineralogy, who will receive a surplus wage of 100 drachmas per month".[72]

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[69] Maximos Maravelakis, "Οι πρωτεργάται της γεωλογίας εν Ελλάδι," *Annales Géologiques des Pays Helléniques* 1 (1947): 16; Stefanidis, *Εθνικόν και Καποδιστριακόν*, 67–68. Notably, Georgalas' list of scientific publications composed by Stefanidis begins no sooner than 1922, indicating Georgalas' lesser stature before 1920.

[70] See Georgios Georgalas, "Συμβολαί εις την γνώσιν των απολελιθωμένων πρωτόζωων της Ελλάδος," *Αρχιμήδης* 15, no. 12 (1914). Two draft copies of this article were discovered during our research in the library of the Physics School of the University of Athens, each bearing a handwritten inscription by Georgalas, addressed to Ktenas and Negris, respectively. The draft copy addressed to Ktenas also bears handwritten corrections of classification mistakes detected by Ktenas, but these corrections were omitted from Georgalas' final published article. This could be either because Ktenas purposefully did not point out the errors he detected, or because Georgalas chose to ignore Ktenas' comments.

[71] For the "cold" relations between Ktenas and Skoufos, see Kandilis, *Οι Θεμελιωταί*, 105, 113.

[72] "Νόμος 780 περί οργανισμού της κεντρικής υπηρεσίας του Υπουργείου της Εθνικής Οικονομίας," *Εφημερίς της Κυβερνήσεως [ΦΕΚ],* no. 179, 29 August 1917. For a few months,

The "attachment" was revoked only a year later. In December 1918, a new position of "inspector geologist" was introduced in the ministry. The clause formerly assigning the direction of the ministry's "mining laboratory" specifically to the "tenured professor of mineralogy" was purposefully complemented. Now "the direction c[ould] also be assigned to another professor of the University … or to the inspector geologist himself".[73] The first "inspector geologist" of the Ministry of National Economy, who also succeeded Ktenas as the director of the ministry's "mining laboratory", was none other than Georgalas.

Ktenas was obviously aware of this turn of events and was planning accordingly. Only four days earlier, two positions for geologists had been created in the Ministry of Transport. The two geologists would be employed "in geological studies and the compilation of geological maps relevant to road and railroad surveying and technical works in general", assisted by "four temporary geologists".[74] The first geologist hired in the Ministry of Transport was Ktenas.

From December 1918 onwards, the Greek state was equipped with two distinct geological agencies, based in two different ministries and bearing similar jurisdictions. The directors of these geological agencies were engaged in a tense professional and scientific competition, extending from the names of the two agencies to the use of the Mineralogical Museum's microscope.[75]

Actual contested matters extended far beyond such petty squabbles. In March 1919, three months after the founding of the two agencies, a "fuel

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the notoriously dysfunctional telephone line of the university's Mineralogical Museum was "mainly used in order to communicate with the administration of mines of the Ministry of National Economy whose recently founded mining laboratory has been installed inside the museum"; APOP, folder 1916–1917, "Κτενάς προς πρυτανεία," 17 October 1917.

[73] "Νόμος 1577 περί τροποποιήσεως και συμπληρώσεως των περί οργανισμού του Υπουργείου της Εθνικής Οικονομίας νόμων," *ΦΕΚ*, no. 258, 28 December 1918.

[74] "Νόμος 1565 περί συμπληρώσεως τίνων του νόμου 972α 'περί τροποποιήσεως των περί δημοσίων έργων νόμων κλπ', του νόμου 1466 'περί αφομοιώσεως των εκτάκτων υπαλλήλων της υπηρεσίας των Δημοσίων έργων' κλπ," *ΦΕΚ*, no. 257, 24 December 1918.

[75] In June 1919 Ktenas' agency acquired the name "Geological Survey", to which he added the word "Greek" whenever possible, much to Georgalas' disdain; "Βασιλικό διάταγμα περί οργανώσεως και λειτουργίας 'Υπηρεσίας Γεωλογικής' εν τη υπηρεσία Μελετών Δημοσίων έργων," *ΦΕΚ*, no. 142, 26 June 1919. In June 1920, Georgalas managed to merge his agency and the "mining laboratory" into a single "Geological Bureau of the Ministry of National Economy"; "Νόμος 2258 περί συμπληρώσεως και τροποποιήσεως των νόμων περί οργανισμού του Υπουργείου της Εθνικής Οικονομίας," *ΦΕΚ*, no. 166, 27 July 1920. In the first account of his agency's work, Georgalas took the opportunity to also provide a detailed catalogue of the "state research assignments" that were "impossible to complete" due to "denied assistance …

committee" was formed in the Ministry of National Economy. The First World War had ended with Greece on the winning side and the doubling of the territory achieved in 1913 was now deemed to be certain. Besides, Greece was about to enter a new war in Asia Minor.[76] The committee was charged with assessing "the usage of the Greek lignite deposits in the postwar period". This was a matter of the utmost strategic importance; an accurate estimate of the quantity and quality of the industrial energy sources within Greek territory was an obvious prerequisite for any future economic or military planning. The "great experts committee" formed to adjudicate the matter was accordingly manned, including no less than 46 of the most notable Greek industrialists, engineers and state officials.[77]

Ktenas and Georgalas, whose agencies were probably formed in anticipation of this urgent task, were both included in the committee, although under a much different status. Georgalas was cited in every page possible as the "Inspector Geologist of the Ministry of National Economy". He took complete charge of the "mining department" of the committee, being the main lecturer in all of its sub-committees. His actual task was to provide a thorough description of the lignite deposits and mining activities in the Greek territory. He thus compiled, edited and gave final approval to each one of the dozens of reports that were produced by mining engineers and members of the committee for each one of the known lignite mines in "Old Greece". Last but not least, he produced reports and rough maps describing the lignite mines of "New Greece" by compiling already existing data and "personal information". When the committee's work was over after six months, in September 1919, Georgalas was cited as the editor of the final report of the committee's "mining department" and had already begun travelling in person in the "New Lands" in order to personally assess lignite deposits.[78]

Ktenas' stature within the fuel committee was much less important. His contribution to the committee's final report was no more than a republished newspaper article, carefully paginated to look completely irrelevant to the

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on the part the relevant laboratory of the National University" and especially denial of access to its "polarising microscope"; Georgalas, *Ίδρυσις και πεπραγμένα*, 9–10.

[76] On 15 May 1919, the Greek army landed in Smyrna "in order to protect the Christian population"; Dakin, *Η ενοποίηση*, 337.

[77] The committee included such notables as industry magnate Nikolaos Kanellopoulos and shipowner and former minister Leonidas Empeirikos; for a full list of the members (in alphabetical order), see Georgios Georgalas, *Επιτροπή επί των καυσίμων*, 5–6.

[78] The committee's work was concluded in September 1919. Georgalas immediately embarked on his first trip to the "New Lands" and was able to include his first-hand "Notes

main body of the report. In this article, Ktenas argued that "the total quantity of the Greek lignite deposits cannot be adequately estimated" due to the "fragmentation and vertical shifting" characteristic of the Greek carboniferous strata.[79] His reserved stance was utterly dismissed in the adjacent pages that were devoted to an article titled "On the urgent need of confirmation of adequate lignite deposits". In this article, Kleisthenis Filaretos, "Industry Inspector of the Ministry of National Economy", argued that all measures should be taken in order to "confront imported anthracite in the future" and that an accurate quantitative estimate of the Greek lignite deposits was absolutely possible by drilling. Indeed, Filaretos proposed the purchase of five drilling machines from the United States. Labour and machinery costs had already been calculated via "correspondence with foreign firms" and amounted to "600,000 drachmas for the first year". When operated "by the inspector geologist of the Ministry of National Economy", the drilling machines would affirm the existence "of 30 million tonnes, and possibly up to 100 million tonnes" of lignite.[80]

Clearly this was a view of the geological endeavour that was much different than the one proposed by Ktenas in his "Preliminary Study". It could be readily applied, it could connect the "inspector geologist" with private interests, and, above all, it promised immediate results. In a rhetorical feat that would come to characterise future reports, the immediate results promised were speculated on before any actual drilling had taken place. Ktenas' name was not mentioned again until several pages later, when the report used the same attitude to approach "other fuels in Greece", and more specifically "the appearances of mineral hydrocarbons".[81] Apparently oil exploration was already underway in Epirus.

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on the lignite area of Serres" in the final version of the committee's report. See Georgalas, ed., *Επιτροπή επί των καυσίμων*, 15, 64–68.

[79] For the original article, see Konstantinos Ktenas, "Οι Ελληνικοί λιγνίται: το ζήτημα της ποσότητος," *Πολιτεία*, 6 March 1919. It is republished in Georgalas, ed., Επιτροπή επί των καυσίμων, 21–22.

[80] Kleisthenis Filaretos, "Εκθεσις περί επειγούσης ανάγκης βεβαιώσεως επαρκών αποθεμάτων λιγνίτου," in Georgalas, *Επιτροπή επί των καυσίμων*, 22–26. Filaretos' estimate was actually a modest one, as at the same time, the "total Belgian coal reserves were given as 'known, 2,500,000,000 tonnes; probable 8,500,000,000 tonnes'"; Alfred Brooks and Morris Lacroix, *The Iron and Associated Industries of Lorraine, the Sarre District, Luxemburg, and Belgium* (Washington: Government Printing Office, 1920), 89. Until 2020, 2.2 billion tonnes had been extracted and used. See "Εξασφαλίζουμε την επάρκεια της χώρας σε ηλεκτρική ενέργεια," Public Power Corporation, accessed 9 April 2023, https://www.dei.gr/el/dei-omilos/i-dei/tomeis-drastiriotitas/symvatiki-paragogi/.

[81] Georgalas, *Επιτροπή επί των καυσίμων,* 79–112.

The Discovery of the Epirus Oil Deposits

Contrary to presently widespread narratives of "incompetence" and "dependence", the Greek state has a history of conducting oil exploration immediately after the annexation of a new territory.[82] The "New Lands" annexed after 1913 were no exception. Especially in the Molitsa River valley in Epirus, near the village of Dragopsa, surface appearances of hydrocarbons were well known to local villagers and "petroleum" was casually used for heating, lighting and medical purposes. In January 1910, N. Vasilakis, a Greek doctor residing in the Ottoman city of Ioannina, learnt of the nearby hydrocarbon appearances from a patient and immediately began efforts to secure a concession from the Ottoman administration. The geologist who was called upon to assess possible deposits was Ludovic Mrazek, esteemed professor of the University of Bucharest and director of the Romanian Institute of Geology. Mrazek arrived in July 1911, inspected surface hydrocarbon appearances in Epirus and left one of his students, C. Niculescu, to continue the work. Niculescu indeed continued with various intervals due to the outbreak of the Balkan Wars, and until 1914 he had acquainted himself with Epirus, well enough to produce several publications on the geology of the area.[83]

The matter resurfaced in 1917, when Vasilakis informed the French expeditionary force based in Ioannina of the hydrocarbon appearances.[84] Before the war was actually over, between 1917 and 1918, the area was repeatedly inspected by joint French and Greek expeditions, manned by military officers and engineers. At the same time, the Greek prime minister, Eleftherios Venizelos, was introduced to the prospects of the Epirus oil deposits by Mrazek himself. The matter was concluded in January 1919 with the founding of a Franco-Greek Petroleum Syndicate that would exploit the "petroliferous strata in Epirus,

[82] The island of Zakynthos, to take a prime example, well-known since the antiquity for its surface hydrocarbon appearances, was ceded by Britain to the Greek state in 1864, along with the rest of the Ionian Islands. Only a year later, in 1865, concessions had already been made to foreign "speculators" and exploratory drilling was well underway; see Henri Coquand, "Description géologique des gisements bituminifères et pétrolifères de Sélenitza dans l'Albanie et de Chieri dans l'île de Zante," *Bulletin de la Société Géologique de France* 25 (1868): 20–74; For a concise introductory history of oil exploration in Zakynthos, see Evangelos Bobos, *Τα πετρέλαια της Ζακύνθου και τα εξ αυτών προϊόντα* (Piraeus: Typ. Efth. Proukaki, 1938).

[83] C. Niculescu, "Contributions à la Géologie de l'Épire (Environs de Janina)," Bulletin de la Section Scientifique de l'Academie Roumaine 3, no. 1 (1914).

[84] Georgios Georgalas, *Αι εν Ηπείρω εμφανίσεις ορυκτών υδρογονανθράκων και αι επ' αυτών ερευνητικαί εργασίαι* (Athens: Ministry of National Economy, 1922), 13–14. Georgalas' source is his personal oral communication with C. Niculescu.

Aitoloakarnania, the Peloponnese and the Ionian Islands", initially funded by the French.[85] The relevant law took care to note that "the petroliferous strata [would be] excluded from laws concerning mine concessions"[86] and that the Greek state retained the right to be the first purchaser of any oil found, "according to its needs".[87] Niculescu was recalled to Epirus, this time as the director of 25 specialised Romanian drillers, and began exploratory drilling on 31 August 1920.[88]

This immediate mobilisation on the part of the Greek state was to be expected. The first decades of the twentieth century had brought about a rapid change in transport technology. The emergence of the internal combustion engine, the introduction of the automobile and, most of all, the transition of the world's navies from coal to oil and oil's subsequent role in World War I, had a "dramatic impact on the way governments viewed the oil industry".[89] The very notion of oil had been transformed from an efficient light source chiefly used in lamps, to an asset of increasingly strategic importance, in peace and – most importantly – war.[90] While Niculescu commenced exploratory drilling in Epirus, Greek Navy officers were familiarising themselves with "liquid fuels used in internal combustion engines".[91] As the Greek state was entering yet another war, this time in Asia Minor, the existence of indigenous oil deposits had become a matter of obvious national importance.

Needless to say, the "Greek oil deposits" aroused immediate interest on the part of the two chief Greek geologists of the time. Of course this required a rapid education course, for neither of them was even remotely acquainted with oil or petroleum geology.

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[85] Pantelakis, *Αλέξανδρος Ν. Διομήδης*, 328–29.

[86] "Περί εξαιρέσεως παραχωρήσεως πετρελαιοφόρων στρωμάτων εν Ηπείρω, Αιτωλοακαρνανία, Πελοποννήσω κλπ," *ΦΕΚ*, no. 82, 17 April 1919.

[87] Pantelakis, *Αλέξανδρος Ν. Διομήδης*, 330.

[88] Georgalas, *Αι εν Ηπείρω*, 21.

[89] David Painter, "International Oil and National Security," *Daedalus* 120, no. 4 (1991): 183.

[90] For oil as "the blood of victory" during the First World War, see Daniel Yergin, *The Prize*, 151–67. On the social and technical aspects of the navy's transition to oil, see Nuno Madureira, "Oil in the Age of Steam," *Journal of Global History* 5, no. 1 (2010): 75–94. For early Greek perceptions of the internal combustion automobile as a means of territory homogenisation, see Christos Karampatsos, "Efrosini Crossing Syngrou Avenue: Automobile Accidents and the Introduction of the Automobile in Greece, 1900–1911," *History and Technology* 33 (2017): 255–79.

[91] Theodoros Varounis, "Καύσις και καύσιμαι ύλαι," *Ναυτική Επιθεώρησις* 5, no. 14 (1919): 226–31. Between 1915 and 1916, Varounis performed "several tests" concerning the use of Zakynthos oil in ship boilers; see Georgalas, *Επιτροπή επί των καυσίμων*, 97.

How the Two Most Prominent Greek Geologists Discovered Oil

Georgalas had never treated "oil" in his scarce pre-1920 scientific publications. Ktenas, on the other hand, as we have seen, had initiated correspondence with Mrazek as early as 1914. However, their correspondence was devoid of any reference to the famous Romanian oil fields or Mrazek's 1911 exploratory activities in Epirus. In fact, Ktenas specifically noted in his 1917 "Preliminary Study" that "the geological conditions prevailing in Romanian territory and therefore the industrial direction of its agency are different than the Greek".[92] In 1917, his rejection of the possibility of the "Greek oil deposits" was as strong as they come.

A year later, Ktenas returned to the matter of the "Greek oil" in a comprehensive newspaper article. He was now aware of the developments taking place in Dragopsa and referred to the matter as "interest aroused on the part of various industrial and technical circles". He had delved into the latest advances of petroleum geology and was now aware that "petroliferous areas" were characterised by the existence of "mineral salt deposits", of the kind found in Epirus.[93] He went as far as to reverse the opinions expressed a year earlier. Now, the "tectonic conditions" prevailing in Western Greece were found to be "analogous to the major petroliferous zones of the Earth". Anyhow, even when trying hard to align his opinions with the latest state initiatives, his disbelief in the existence of oil deposits remained evident. The article concluded that "even in the most probable case, that is, if exploration does not provide us with satisfactory results, the discovery of new asphalt deposits … should be sufficient to cover any relevant cost".[94]

His careful stance earned Ktenas another honorary mention in the 1920 final report of the fuel committee, where his two-page article was once again republished with no comments whatsoever. It was followed by a 33-page "rough memorandum", where Georgalas exhibited his newly acquired knowledge on hydrocarbon appearances within Greek territory. This was an effort to summarise previous exploratory and exploitation attempts since 1865 via a thorough perusal of relevant literature. It contained a particularly detailed section on Zakynthos, implying personal communication with Dionysios Kollaitis, the major wildcatter active in the island since 1911, and intimate knowledge of the "tests" conducted by the Greek Navy to assess the compatibility of Zakynthos' oil with Greek ship boilers.[95] Matters looked most promising in Epirus, where "surface hydrocarbon appearances

[92] Κτενάς, *Η γεωλογική υπηρεσία*, 22.

[93] Interestingly, the idea that "salt diapirs … provide an effective seal for hydrocarbons" was first introduced by Ludovic Mrazek; see Constantin Roman, *Continental Drift: Colliding Continents, Converging Cultures* (Boca Raton: CRC Press, 2000): 12.

[94] Konstantinos Ktenas, "Ελληνικόν πετρέλαιον: Μία σοβαρά ελπίς," *Αθήναι*, 15 July 1918.

[95] Georgalas, *Επιτροπή επί των καυσίμων*, 95, 97.

[were] more numerous than anywhere else". Always ready to recognise an "urgent need", Filaretos had already visited the area and taken asphalt samples. Apart from that, Georgalas referred to Niculescu's 1914 and 1917 publications, according to which the Molitsa River valley was shaped as a "diapiric anticline", of the type "firstly recognised by Professor Mrazek in the petroliferous areas of Romania".[96] His memorandum concluded that "in Greece – and especially in Epirus – … all conditions that, according to Mrazek, are necessary for the shaping of hydrocarbons are met".[97] As elsewhere in the report, Georgalas' "results" were summarised in a folding map of "the hydrocarbon appearances in Greece" aimed at impressing the fleeting reader with its size and comprehensiveness (fig.2).

Figure 2. The "appearances of mineral hydrocarbons in Greece", as depicted by Georgios Georgalas in the report of the fuel committee (1920). Notice the absence of borders. (Georgios Georgalas, ed., *Επιτροπή επί των καυσίμων: Πορίσματα, εκθέσεις και υπομνήματα του μεταλλευτικού τμήματος αυτής* [Athens: Ministry of National Economy, 1920], appendix.)

[96] Ibid, 101.

[97] Ibid. Georgalas included a reference to Ludovic Mrazek, *L'industrie du pétrole en Roumanie: Les gisements du pétrole* (Bucharest: Independenta, 1916).

Ktenas and Georgalas spent the years between 1920 and 1922 summarising their hastily gathered knowledge on the Greek oil deposits in extended essays, published by all means at their disposal and providing ample evidence of their differing scientific demeanours and tactics.[98] Ktenas' 1920 essay was a lengthy compilation of earlier stratigraphic works and more recent observations made using the mineralogical collections of the university museum. It was obvious that Ktenas had never visited most of the areas described, or that he had visited them for reasons other than oil exploration. His scepticism on the existence of hydrocarbon deposits in Western Greece was evident, fuelled among other things by "the absence of recent volcanic activity that could have led to hydrocarbon formation".[99] In his conclusions, Ktenas did not discourage exploratory drilling, provided – as always – that it was preceded by "a detailed geological and indeed tectonic analysis".[100] Unsurprisingly, his "Geological Survey" was now planning to initiate such an "analysis". The "detailed geological mapping of the territory" that no one yet had asked for, would begin "from the western parts of Greece" (fig. 3).[101]

Georgalas' treatise on the Epirus hydrocarbons was an altogether different beast. It began by pointing out the strategic significance of "king oil" and predicting the imminent "practical disappearance of anthracite".[102] It went on to portray Georgalas' special mediating position between the Franco–Greek Petroleum Syndicate and the Ministry of National Economy. Thanks to this relation, Georgalas not only enjoyed access to Niculescu's reports to the syndicate, but he had had the opportunity to personally visit the site of the exploratory drillings in the company of Niculescu himself.[103] During this trip, which took "6 hours to cover a distance of 16 km" from Ioannina to the Molitsa River valley, Niculescu provided a history of the previous Epirus exploits, as well

[98] Ktenas' essay was published in its full form as Konstantinos Ktenas, "Η υδρογονανθρακούχος ζώνη της Δυτικής Ελλάδος," in *Υπομνήματα της γεωλογικής υπηρεσίας*, no. 1, ed. Konstantinos Ktenas (Athens: Ministry of Transport, 1920). A summary was published as Ktenas, "Η υδρογονανθρακούχος ζώνη της Δυτικής Ελλάδος κατά τον Κ.Α. Κτενά," *Αρχιμήδης* 21, no. 6 (1920): 47–49; the same summary was presented in French in the *Comptes Rendus de l'Académie des Sciences* 170 (1920): 737; see Ktenas, *Κατάλογος επιστημονικών δημοσιεύσεων Κωνσταντίνου Κτενά* (Athens: Estia, 1931), 5. The essay by Georgalas was published in 1922 as Georgalas, *Αι εν Ηπείρω εμφανίσεις*. It was also presented before the Greek Society of the Physical Sciences in March 1921 and published in *Δελτίον της εν Ελλάδι Εταιρείας των Φυσικών Επιστημών* 2, no. 9–10 (1921).

[99] Ktenas, *Η υδρογονανθρακούχος*, 78.

[100] Ibid., 82.

[101] Ibid., 55.

[102] Georgalas, *Αι εν Ηπείρω εμφανίσεις*, 5.

[103] Ibid., 21, 29. Georgalas' visit probably took place during the autumn of 1920.

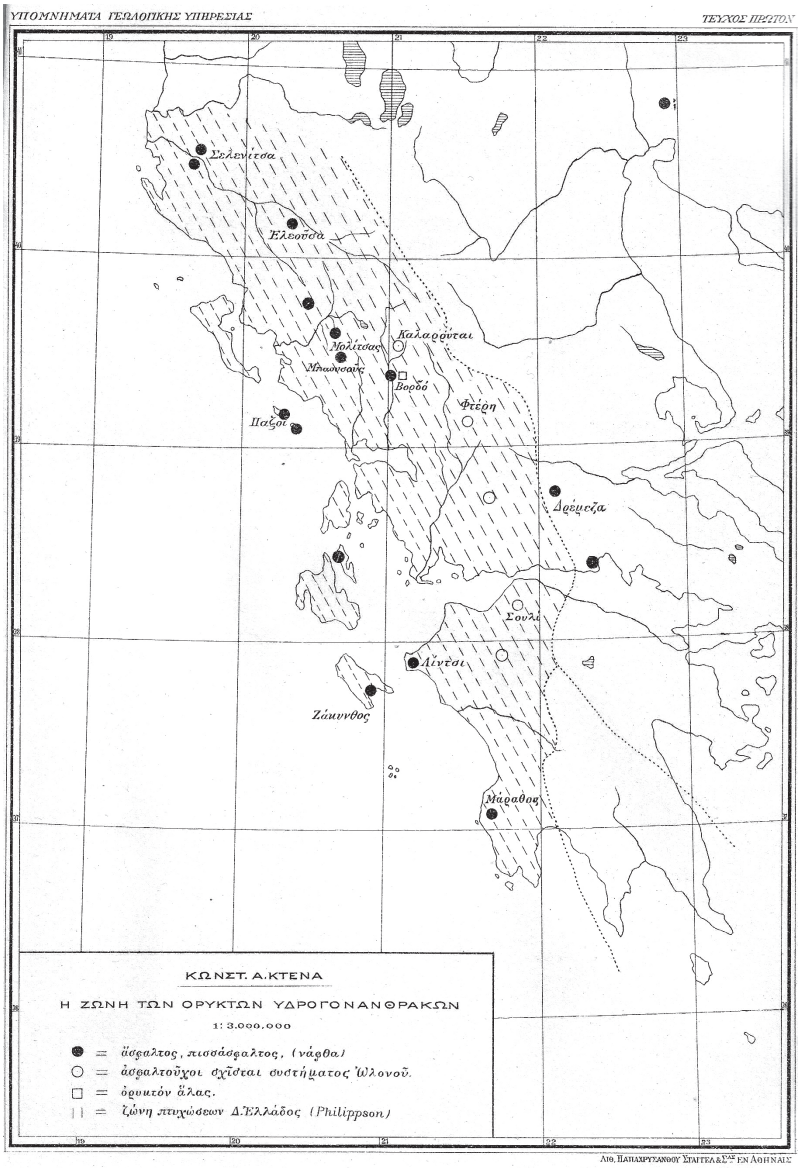

Figure 3: "The zone of mineral hydrocarbons", as depicted by Konstantinos Ktenas in 1920. This map is clearly rougher than the one produced by Georgalas in the same year (fig. 2), indicating Ktenas' haste to publish a report as soon as possible. Evidently, even the ample resources of the university's mineralogical laboratory had reached their limits. (Konstantinos Ktenas, "Η υδρογονανθρακούχος ζώνη της Δυτικής Ελλάδος," in *Υπομνήματα της γεωλογικής υπηρεσίας*, vol. 1, ed. Konstantinos Ktenas [Athens: Ministry of Transport, 1920], 87.)

as useful insights into the stratigraphy of the area.[104] Furthermore, Georgalas was allowed to inspect in person the drillings performed and describe them in detail, complete with their "1 square meter cross-section and wooden panelling", characteristic of the Romanian drillers' working style, and the exact results of each drilling attempt "up to 31 December 1921".[105] With such *in situ* information available, Georgalas could keep general stratigraphic observations at a minimum, apart from the ones actually related to oil. Indeed, Mrazek's "diapiric anticline" notion was portrayed as a geological theory possessing the rare trait of immediate practical application: it could direct actual drilling attempts so that they "define the extent of the deposit under the hypothesis that the carboniferous strata meet underground, enclosed by the impermeable salt-bearing strata".[106]

The conclusions were a potent display of the geological rhetoric we have already witnessed in the fuel committee's report. Georgalas calmly divided the question of the Epirus oil deposits in two distinct parts. The first part of the question concerned the existence of oil in Epirus. Here the answer was "definitively positive". The analogies of the "carboniferous zone of Western Greece" to the Carpathian one were plenty, extending from their "genesis" and age to the existence of "diapiric anticlines" and the appearance of oil in "secondary deposits inside younger strata protected by older ones". The argument was strengthened by extracting all of Ktenas' reservations from previous articles and refuting them one by one, in an obvious effort to portray Ktenas as the foremost expert opposing oil exploration.[107] The second part of the question concerned the economic viability of the oil deposits. Regrettably this was "impossible to answer"; according to Mrazek "an estimate of this kind of deposits is difficult, if not impossible … and when Mrazek speaks thus, I am forced to fall silent".[108]

Meanwhile, those charged with producing the relevant public discourse were quite vocal. Greek newspapers routinely published articles that analysed oil's strategic significance and prospects, usually anonymously. Readers were reminded of the "Zakynthos oil deposits".[109] French policy during the Greek–Turkish War was

[104] Ibid., 16–20, 29.

[105] For the "skill and resourcefulness" displayed by Romanian drillers as well as some "photos of everyday work" reminiscent of Georgalas' verbal descriptions, see Francesco Gerali and Jenny Gregory, "Understanding and Finding Oil over the Centuries: The Case of the Wallachian Petroleum Company in Romania," *Earth Sciences History* 36, no. 1 (2017): 54–55. The results of the drillings are described in detail in Georgalas, *Αι εν Ηπείρω εμφανίσεις*, 21–24.

[106] Georgalas, *Αι εν Ηπείρω εμφανίσεις*, 21.

[107] Ibid., 25.

[108] Ibid., 24, 28.

[109] Anonymous, "Το ελληνικόν πετρέλαιον," *Εμπρός*, 12 December 1919.

explained via reference to the "oil of Mosul".[110] Oil was allegedly discovered in the Trikala vicinity in Thessaly during a water-drilling attempt.[111] Proposals submitted by "English investors" to install an oil refinery in Piraeus were being "seriously considered" and soon to be followed by "the great American oil firm Standard Oil Company"; a "large Anglo–Persian company [sic] [had] already submitted an exploitation proposal for the petroleum sources of Epirus and Macedonia".[112] Greek public discourse between 1919 and 1923 is an early instance of the "fusion of catastrophe and exuberance" characteristic of twentieth-century oil discourse.[113]

This is not surprising given the political turbulence and rapid reversals that characterise the period. The elections of November 1920 once more brought to power the anti-Venizelist alliance and reinstated pro-German King Constantine as head of state. Ominous developments on the Asia Minor front from 1921 onwards led to the country's increasing diplomatic isolation.[114] The impeding military disaster also spelt disaster on the oil front. The Franco–Greek Petroleum Syndicate abandoned the Epirus exploration project after February 1922, presumably under orders from "Paris".[115]

Georgalas proved to be a skilful navigator in these tumultuous seas. Political circumstance favoured him; Skoufos was reinstated to his former university chair after the 1920 election and, in the same year, Georgalas was at long last appointed a tenured professor of geology and mineralogy in the newly formed Agricultural School of Athens.[116] He presented his Epirus oil essay in a speech before the

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[110] Εμπροσθοφύλαξ, "Το παράδοξον αίνιγμα της γαλλικής τουρκοφιλίας," *Εμπρός*, 25 April 1921.

[111] Anonymous, "Πηγαι πετρελαίου εις τα Τρίκαλα," *Εμπρός*, 20 December 1921.

[112] Anonymous, "Αι εγκαταστάσεις πετρελαίου εν Πειραιεί: Η κυβέρνησις δέχεται τας προτάσεις," *Εμπρός*, 6 August 1922. The confusion between the various companies that had resulted after the 1911 breaking up of the Standard Oil Co. and the mistaken reference to the "Anglo–Persian Co." testify to the novelty of the matter among Greek journalists. Also note that the reference to "Anglo–Persian" was not completely imaginary; the D'Arcy Exploration Co. actually involved (see below, n. 120) was a subsidiary of the Anglo–Persian Oil Company that specialised in exploratory drilling; Yergin, *The Prize*, 132.

[113] Frederick Buell, "A Short History of Oil Cultures; or, The Marriage of Catastrophe and Exuberance," in *Oil Culture*, ed. Ross Barret and Daniel Worden (Minneapolis: University of Minnesota Press, 2014), 83.

[114] Yanis Yanoulopoulos, "Εξωτερική πολιτική," in Hadziiossif, *Ιστορία της Ελλάδας στον 20ο αιώνα*, vol. A2, 135.

[115] Pantelakis, *Αλέξανδρος Ν. Διομήδης*, 330.

[116] Stefanidis, *Εθνικόν και Καποδιστριακόν*, 67. Dimitrios Panagiotopoulos, "Γεωργική εκπαίδευση και ανάπτυξη: Η συμβολή της ανωτάτης γεωπονικής σχολής Αθηνών" (PhD diss., Ionian University, 2003), 68.

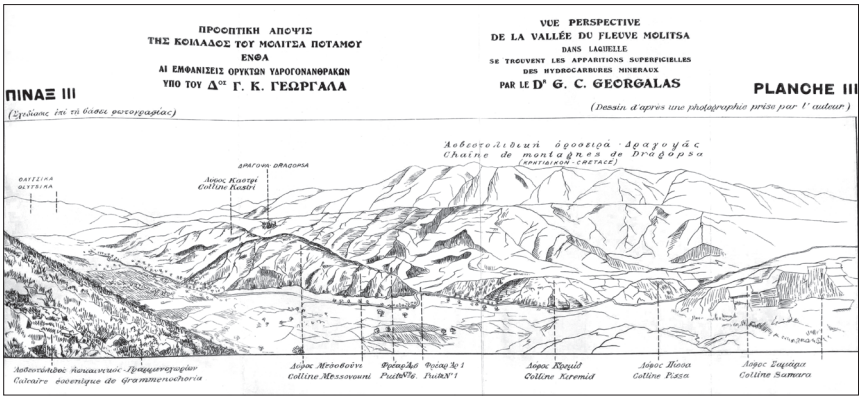

Figure 4. The Molitsa River valley, as depicted by Georgalas "on the basis of a photograph", that was presumably taken during his trip with Niculescu. Dragopsa village appears to the upper middle and left. Some of the drillings performed by the Romanians are also indicated. (Georgios Georgalas, *Αι εν Ηπείρω εμφανίσεις ορυκτών υδρογονανθράκων και αι επ' αυτών ερευνητικαί εργασίαι* [Athens: Ministry of National Economy, 1922], table 2.)

Greek Society of Natural Sciences in 1921. He republished it in 1922, under the auspices of his Geological Bureau, including, as usual, several expensive folding maps of the areas mentioned (fig.4). He learnt how to calmly intervene in the public oil discourse[117] and would scientifically examine and eventually disprove the existence of the alleged "Trikala petroleum source".[118] He even found time to venture into timely practical applications of his science, such as "war geology".[119]

In early August 1922 Georgalas was selected to travel to Belgium as the "official Greek representative" at the 13th International Geological Congress. He was on a sensitive mission of national importance. Efforts to involve the D'Arcy Exploration Company in exploration attempts in Macedonia were underway.[120] Georgalas was aiming to attract foreign oil investment to Western Greece in an effort to replace the French. He summarised his Epirus oil essay before his peers

[117] Anonymous, "Πετρέλαιον εις Τρίκαλα;," *Εμπρός*, 24 December 1921.

[118] Georgios Georgalas, "Natural Gas in Thessaly," *Economic Geology* 19, no. 1 (1924): 95.

[119] Georgios Georgalas, "Πολεμογεωλογία," *Το Μέλλον* 4, no. 39–40 (1922): 10; in this article Georgalas perused recent international literature and concluded that "geology should be a part of military training" and that a "geological corps should accompany the military cadre"; On the development of "military geology", see Edward Rose, "Military Geology: An American Term with German and French Ancestry," *Earth Sciences History* 38, no. 2 (2019): 357–70.

[120] "Νόμος 2910 περί εξερευνήσεως της Ανατολικής και Δυτικής Μακεδονίας προς ανεύρεσιν και εκμετάλλευσιν πετρελαίου," *ΦΕΚ*, no. 138, 7 August 1922.

and modestly concluded that "interesting future [oil] applications" in Epirus were after all "not impossible".[121]

As far as Greek oil ambitions were concerned, the mission was a complete failure; the Greek Army in Asia Minor collapsed a few days later, making all oil conversation redundant. In 1923 Georgalas applied for funding in order to "perform exploratory drilling" in the area of Tavri, Thrace. "Regrettably," though, his application was rejected.[122] His personal ambitions were faring a lot better. At long last he had acquired tenure, even if it was at the Agricultural School. He had been officially recognised as the foremost oil expert in Greece. He had even forced Ktenas to participate in the congress as an independent researcher "at his own expense".[123]

This status proved to be impervious to the political turbulence of the next few years. Between 1924 and 1925, Georgalas took advantage of an ongoing conversation on "state economies" to propose the merging of the two geological agencies into a single entity, under his direction. Despite his initial angry response, Ktenas was eventually forced to grudgingly accept a compromise.[124] In 1925 the two agencies were officially merged. The new agency was named the Geological Survey of Greece and was thereafter based in the Ministry of National Economy under the direction of Georgalas. In exchange, Ktenas' disciple Georgios Voreadis was moved to the new agency as Georgalas' subordinate.[125] Ktenas had to content himself with being one of the founding members of the Academy of Athens, formed in 1926. He never again published something on "Greek oil" or "Greek lignite".

Geology and Oil Exploration in the 1930s

Ktenas died prematurely in 1935. He was unable to complete "his life's work", which after the unfortunate events described here, apparently had come to be

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[121] G.C. Georgalas, *Les hydrocarbures naturels en Grèce: Extrait du Compte Rendu du XIIIe Congrès géologique international 1922* (Liege: Vaillant-Carmanne, 1926), 1359.

[122] Georgios Georgalas, "Υπάρχουν πετρέλαια εν Ελλάδι;, Γ'," *Χημικά Χρονικά* 2, no. 4 (1937), 82.

[123] Ktenas narrates these traumatic events in Konstantinos Ktenas, "Επιστολή," *Ελεύθερον Βήμα*, 21 July 1924. In 1921, his funding application for a "thorough exploration of the Erythrae peninsula" in Asia Minor was also rejected, thus putting an end to his "geological continuity" notion; see Karampatsos, "Το γενικότερο συμφέρον," 148.

[124] Georgios Georgalas, "Επιστολή," *Ελεύθερον Βήμα*, 19 July 1924; Ktenas, "Επιστολή"; Georgalas, "Αι γεωλογικαί υπηρεσίαι," *Ελεύθερον Βήμα*, 27 July 1924.

[125] Georgios Georgalas, "Το ιστορικόν της ιδρύσεως της γεωλογικής υπηρεσίας της Ελλάδος," *Χημικά Χρονικά* 38, no. 11–12 (1973): 262.

understood as "the study of the tertiary and quaternary lavas of the Aegean".[126] He was also unable to witness the next appearance of the "Greek oil deposits" during another period of major political turbulence and expectation of war. Indeed, in early 1936, only months before the imposition of the Metaxas dictatorship, "large oil deposits" were discovered in Western Thrace. Since the matter was of "colossal importance",[127] in the following months Greek newspapers ventured deeper into its intricacies. The most informed series of relevant articles appeared in the *Οικονομολόγος Αθηνών* newspaper only a few days after the dictatorship was declared, and went on until January 1937. Here "ancient writers", like Herodotus, were once more recruited to certify the existence of oil deposits. Next to them one could find "the director of the Geological Survey G. Georgalas, [who] as early as 1920 scientifically examined the Ioannina region with quite satisfactory results". What's more, the exploratory drillings were now taking place "in Tavri village, near Alexandroupoli", the exact place of Georgalas' 1923 rejected drilling proposal. The titles and argumentation of the articles were invariably formulated following a familiar rhetorical ploy that was now condensed in a deceptively simple question: "Is there oil in Greece?"[128]

As we have seen, Georgalas was aware of this ploy and its merits since 1921. He could now further explore its potential from a new position, as in January 1937 he took over Ktenas' vacant university chair. The installation ceremony, which took place in the institution's Great Hall, was attended by "His Majesty the Crown Prince, the dean, the professors and a host of other notaries from the scientific and literary world". They all witnessed Georgalas' inaugural address, titled "Is there oil in Greece?" The answer to this familiar question was formulated in the usual manner. Greece "certainly possessed oil deposits,

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[126] In 1969, Georgios Marinos collected, edited and published Ktenas' previous work concerning the island of Ikaria. Marinos deemed it "unnecessary" to publish Ktenas' views on the "tectonic connections" between the Aegean and Asia Minor included therein; see Marinos, ed., *Γεωλογία της νήσου Ικαρίας*, 62, 67.

[127] E. Tzamouranis, "Έχει και η Ελλάς πηγάς πετρελαίου – Το πολύτιμον υγρόν – τι ευρέθη εις Θράκην," *Αθηναϊκά Νέα*, 6 February 1936.

[128] Anonymous, "Υπάρχει Πετρέλαιον εν Ελλάδι;," *Οικονομολόγος Αθηνών*, 15 August 1936; an article with the exact same title had appeared in the same newspaper in 1933, when the Greek state began auctioning concessions for Macedonia and Thrace; Anonymous, "Υπάρχει πετρέλαιον εν Ελλάδι;," *Οικονομολόγος Αθηνών*, 28 January 1933; also see Ar. Avramidis, "Υπάρχει πετρέλαιον εν τη Δυτική Θράκη;," *Οικονομολόγος Αθηνών*, 5 December 1936, and Avramidis, "Διεπιστώθη η ύπαρξις πετρελαίου εν τη Δυτική Θράκη," *Οικονομολόγος Αθηνών*, 9 January 1937. For accounts of the post-1930 Greek oil exploration attempts, see Pantelakis, *Αλέξανδρος Ν. Διομήδης*, 331–45; the newspaper articles are cited in Christos Hadziiossif, *Η γηραιά σελήνη: Η βιομηχανία στην Ελλάδα 1830–1940* (Athens: Themelio, 1993), 194–95.

although of unknown quantity and synthesis". Exploratory drilling had to be "immediately performed" in areas where "serious scientific evidence of the possibility of oil deposits exists". The foremost of these areas was "the vicinity of Dragopsa in Epirus". Georgalas' solid argumentation on "the serious evidence of possibility" was met by "vigorous and extended applause".[129] The exploration attempts conducted in the four following years remained fruitless.[130]

The dispute was – at long last – settled and a certain "reality" concerning the Greek oil deposits had been produced. It persists until today.

Conclusion: On Geology, Reality and the "General Interest of the State"

Scholars working in the fields of the history of science and technology have long argued that science should be treated as a human practice deeply embedded in wider societal structures, interests and aspirations. This point is further refined in the work of historian of science Naomi Oreskes. In a case study concerning US oceanography during the Cold War, Oreskes shows that US oceanographers "actively sought opportunities for Navy sponsorship and attempted to forge a symbiotic relationship" with the US Navy. This led to a preoccupation with specific scientific questions that "came into focus through the crosshairs of national security". In the case of US oceanography, scientific questions stemmed from a powerful "context of motivation", much more related to the accommodation of personal interests within the wider historical context, than to the "internal logic" of science.[131]

The "context of motivation" active in the case of the two most prominent Greek geologists of the 1910s was equally powerful. The doubling of the Greek territory accomplished after 1913 provided "men serving the natural sciences" with a veritable "civilising mission", meaning the implementation of Greek state power in the "New Lands" through technopolitical means. An estimate of the quantity and quality of the industrial energy sources within Greek territory was an obvious prerequisite for any future economic or military planning. Oil's strategic significance was made apparent during the First World War, and was readily comprehended in Greece, a country readying itself to embark on a war of its own in Asia Minor.

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[129] Anonymous, "Τα πετρέλαια της Ελλάδος: Τι είπεν ο κ. Γεωργαλάς," *Αθηναϊκά Νέα*, 29 January 1937; This article summarises the conclusions of Georgios Georgalas, *Υπάρχουν πετρέλαια εν Ελλάδι; Εναρκτήριον μάθημα εν τω Πανεπιστημίω (28-1-1937)* (Athens: Chimika Chronika, 1937), 67–70.

[130] Pantelakis, *Αλέξανδρος Ν. Διομήδης*, 345.

[131] Oreskes, "A Context of Motivation," 726, 730.

Inevitably, Ktenas and Georgalas perceived this powerful "context of motivation" through the lens of their scientific discipline. They were both trained as typical early twentieth-century geologists. They were accustomed to a stratigraphic view of the subsoil, meant to "make of the nation a single geological specimen that could be understood as a legible and logical whole".[132] At the same time though, this view was increasingly suspect of irrelevant accounts and problematic relations with "practical application". The "divide between 'pure' and 'practical' research" in geology was being renegotiated all around the world.[133] Greece was no exception, although in this case, any "practical application" of geology had to take into account an urgent military and strategic aspect.

The scientific work performed by Ktenas until 1920 was materialised under the powerful influence of this "context of motivation". As we have seen, Ktenas invested his early scientific work in two large-scale scientific undertakings. The "geological continuity of the Greek Lands" and the founding of a Greek Geological Survey were both designed to be a "translation" of the "general interest of the state" into Ktenas' stratigraphic language. The crowning achievement of this strategy was his article on the "anthracites of Greece". As demonstrated in this article, a savant professor of geology could produce a depiction of the "geological continuity" of the future Greek territory and, at the same time, transform "the search for anthracite … into a matter of a purely theoretical nature", simply by complementing old stratigraphic descriptions with his own.[134] His vision for a Greek Geological Survey and a "comprehensive geological map of the territory", presented in the same year, was no more than a laborious application of this methodology until it managed to accurately describe the sum of the territory in about 50 years. In the process, Ktenas would have risen to become chief geologist in Greece.

The 1920 report of the fuel committee offers a glimpse into a much different perception of the relation between geology, industry and the state. From this point of view, concisely summarised by industrial inspector Filaretos, Ktenas' comprehensive vision must have seemed rather outlandish. The Greek state had exited three consecutive wars and was about to enter another. An immediate "confirmation of adequate lignite deposits" was "an urgent need", indeed urgent

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[132] For a short account of the emergence of "historical (or 'stratigraphical') geology" in the nineteenth century, see Bruce Braun, "Producing Vertical Territory: Geology and Governmentality in Late Victorian Canada," *Cultural Geographies* 7, no. 1 (2000): 15–24; the quote on 22.

[133] Lucier, "A Plea," 286.

[134] Ktenas clearly thought that this achievement was impressive enough to be used as his opening argument; Ktenas, "Οι λιθανθρακες Α΄," 2–3.

enough to be rhetorically performed before any exploration. Filaretos' estimate of between "30 and 100 million tonnes" of lignite seemed arbitrary; in fact it drew ample legitimacy from pressing historical circumstance, as well as from its compliance with short-term interests. The purchase of expensive equipment, the hiring of skilled and unskilled workers, the power to officially assess private lignite deposits, and 600,000 drachmas of funds, could well transform the "inspector geologist" into an indispensable appendage of the mining industry and connect him to private interests in a manner that was much more convincing and feasible than Ktenas' "endless undertaking", which presented itself as novel but was in fact reminiscent of various dubious nineteenth-century attempts to connect geology and the state.[135]

Strongly motivated by their occupational dispute and his inferior position, Georgalas proved to be much more compatible than Ktenas with the Ministry of National Economy's approach, much more willing to forego the prerequisite of a "complete geological study" and provide "actual results". This is most evident in the way he accommodated his stratigraphic training within the needs posed by oil exploration. The result was a view of the geological endeavour that was much different than the one proposed by Ktenas. This was an idiom constructed via the fusion of geological knowledge, personal relations, evasive rhetoric and political intuition. Granted, this meant that words such as "possibly", "probably", "most certainly" and "maybe" had to be repeated three to four times in the same paragraph of his early reports. But any ambiguity was invariably lifted in the opposite page where "results" were carefully tabulated or sketched into "rough geological maps".[136] The rhetorical ploy invented in 1921 between "is there oil" and "is this oil exploitable" served to eliminate all speculation. As is often the case with oil discourse, it focused on "what people know and what they know they do not know". At the same time it summarised "fragmented knowledge and bits of partially obscured geological matter" in an effort to transform speculation into "reality".[137]

Indeed, "reality" often results as "the consequence of the settlement of a [scientific] dispute rather than its cause".[138] The dispute described here did

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[135] Pietro Corsi, "Introduction to Thematic Set of Papers on Geological Surveys," *Earth Sciences History* 26, no. 1 (2007), 7. Corsi argues that European geological surveys of the kind proposed by Ktenas had to constantly deal with "repeated administrative or political threats to put an end to an endless undertaking".

[136] For an example, see Georgalas, *Επιτροπή επί των καυσίμων*, 50, 54.

[137] Weszkalnys, "Geology, Potentiality, Speculation," 622.

[138] Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts* (1979; Princeton: Princeton University Press, 1986), 236.

not take place exclusively in laboratories and certainly was not of the "purely scientific" kind. It was a messy thing, conducted for decades under the powerful gravitational field of a "context of motivation" made of national interest, personal ambition and historical circumstance. Yet it produced the "reality" regarding "the Greek oil deposits" in a very strong sense.

The sort of "reality" produced was not the exclusive intellectual property of Georgalas. On the contrary it characterises the international oil exploration discourse since its beginnings. Scholars that have treated similar cases of fruitless oil exploration have rightly detected a fusion of practices, such as exploratory drillings, geological reports and skilful rhetoric, carefully designed to "materialise an absent potential and promise future gain". The result constitutes "an extended meanwhile in which [oil] potentiality is reassured".[139]

A Greek version of this "oil potentiality" was produced during the fruitless Epirus oil exploration in 1920. It was efficiently manipulated by Georgalas, and was a significant factor in the outcome of his dispute with Ktenas. It was further refined thereafter, as Greek oil exploration attempts followed the "long periods of dormancy characteristic of the industry".[140]

The reality thus produced is a peculiar one; it is made of "history", "geology" and tacit political and rhetorical knowledge amassed during one-and-a-half centuries of Greek oil exploration attempts. Expectedly, it resurfaces again and again, along with every resurfacing of the "oil matter".[141] On 16 October 2014, new oil exploration attempts began in the Dragopsa vicinity by a "consortium of Repsol and Energean Oil". An information meeting was organised in nearby Ioannina city. The audience gathered for the occasion heard an enlightening speech by an expert geologist "employed for many years in the Public Petroleum Corporation and now returning to the area with the Energean Oil & Gas Company". According to him, "we know that an oil system exists but we do not know the whereabouts of the deposit". "Yet," an article concluded, "nowadays, science, technology and the means provided by our era present us with possibilities that did not exist a few years ago. Data gathering is already

[139] Weszkalnys, "Geology, Potentiality, Speculation," 616, 620. The case studied by Weszkalnys is São Tomé and Príncipe, where oil exploration has been conducted since 1876 with meagre results.

[140] Ibid., 614.

[141] For the resurfacing of the attempts to explore for Epirus oil under a different "context of motivation" in the 1950s, see indicatively G. Vanzios, "Ο Ορυκτός πλούτος της Ηπείρου," *Ηπειρωτική Εστία* 17 (1953): 970–75; also I. Marinos, V. Andronopoulos and N. Melidonis, "Το υπέδαφος της Ηπείρου," *Ηπειρωτική Εστία* 87–90 (1959): 572–78.

underway … the first drill will be installed in three years."[142] Seven years later, no drilling had taken place. Repsol had reportedly decided to abandon Greece.[143]

The peculiar reality of the Greek oil deposits was produced a hundred years ago; it might as well persist for a few more.

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[142] Anonymous, "Ένας αιώνας έρευνας για τα πετρέλαια των Ιωαννίνων σε δέκα ασπρόμαυρα ντοκουμέντα," *Epiruspost.gr*, 16 October 2014, accessed 9 April 2023, https://bit.ly/41J1x11.

[143] Christos Kolonas, "Τι συμβαίνει με τα πετρέλαια στην Ελλάδα:10 χρόνια μετά και ούτε μία γεώτρηση," *in.gr*, 4 April 2021, accessed 5 April 2021, https://www.in.gr/2021/04/04/economy/oikonomikes-eidiseis/ti-symvainei-ta-petrelaia-stin-ellada-10-xronia-meta-kai-oute-mia-geotrisi/