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INCREASE IN OUR ARTILLERY URGENTLY NEEDED.

It was only a few years ago that the country awoke to the fact that it was absolutely without modern sea coast defenses. To-day it finds itself in possession of a growing number of forts and guns, but has not sufficient trained gunners to man them.

It now appears that although the work of reconstruction has been carried on with commendable zeal, no provision whatever has been made for manning the guns, and we are now at a stage where the question of an immediate increase in the artillery must be faced without delay.

Gen. Wingate insists that modern guns without gunners are as useless as guns without gun carriages, and that the calmness with which the present critical condition of affairs is borne by the nation is nothing less than wonderful.

There is a danger lest the present generation, in looking at the final triumphs of the civil war, should lose sight of the difficulties experienced at the outset in securing arms, officers or discipline.

Good work of this kind can only be obtained from carefully trained men. It is granted that in time of war a proportion of the detachment of a heavy gun may consist of new enlistments, but the proportion of these cannot safely exceed three-quarters.

It is not at present practicable to provide these forces from the National Guard of the States. What is needed, and needed at once, is a sufficient force of trained gunners, men who devote their entire time to their duties and are always in a state of high efficiency.

training of this force should include a large amount of practice in target firing, and this could be carried out at moderate cost by fitting the large guns with auxiliary barrels of small caliber.

Although Gen. Wingate does not think it practicable to utilize our civilian soldiers in manning our heavy guns, he thinks that the government should encourage the National Guard to form field batteries, as the service of a light battery is acquired with much less difficulty than that of heavy artillery.

The risks of war are as certain as any other risks to which a nation is exposed, and for New York the risk of bombardment, on account of the vast concentration of wealth and property, is doubly great.

REPORT OF THE INTERSTATE COMMERCE COMMISSION.

The Ninth Statistical Report of the Interstate Commerce Commission for the year ending June 30, 1896, has just been submitted.

The total mileage was 182,776, an increase of 2,119 for the year. The largest increase, 233 miles, was in Georgia and the next largest, 202 miles, in California.

The total number of locomotives in service was 35,950, an increase of 251 over the preceding year. The number of cars was 1,297,649, an increase of 27,088.

This vast system employed 826,620 men, an increase of 41,586. Of these, 31,792 were employed in the general administration; 243,627 in maintenance of track and structures; 167,850 in the locomotive and car shops; and 373,747 in conducting transportation.

The amount of railway capital at the close of the year was \$10,566,865,771, or \$59,610 per mile. The funded debt was \$5,340,338,502.

The number of passengers carried during the year was 511,772,727, an increase of 4,351,375 over the preceding year. The year was remarkable as witnessing the largest total of freight carried in the history of railroads in this country.

The gross earnings for the year were \$1,150,169,376, an increase of \$74,797,914. This was made up mainly as follows: Passenger revenue, \$266,562,533; carriage of mails, \$32,379,819; express matter, \$24,880,383; freight revenue, \$786,615,837.

These expenses were assigned as follows: Maintenance of way and structures, 160 millions; conducting transportation, 440 millions; maintenance of equipment, 133 millions; general expenses, 36 millions.

The income from operation, that is, the gross earnings, after deducting operating expenses, was over 377 millions, an increase of over 27 millions. The income from other sources, chiefly leases and investments, was 129 millions, making a total income of 506 million dollars for the year. The total deductions from income were \$416,573,137, so that the net income out of which dividends and surplus were declared was \$89,631,926. This amount is 33 millions of dollars larger than the corresponding one for the previous year. The dividends declared were \$87,603,371.

The statistics show that the slaughter of railway employes continues with ghastly activity, the number of killed being 1,861, an increase of 50, and the number of wounded being 29,969, an increase of 4,273—and yet forsooth the railways are asking to be excused from equipping their trains with safety appliances. The number of passengers killed was 181, and 2,873 were injured, an increase of 11 killed and 498 injured. The number of persons other than employes and passengers killed was 4,406, and the number injured was 5,845; these figures include casualties to persons reported as trespassers, of whom 3,811 were killed and 4,468 were injured. The number of passengers carried for one passenger killed was 2,827,473, and one passenger out of 178,132 was injured. The immunity of passengers from accident is shown by the ratios based upon the number of miles traveled, from which it appears that 72,093,963 passenger-miles were traveled for every passenger killed, and 4,541,945 passenger-miles for every passenger injured. This is a satisfactory showing, and contrasts sharply with the terrible fatalities among employes, where one man out of every 444 was killed, and one man out of every 28 was injured. The figures for trainmen are still more shocking, for of these, 1 man out of every 152 was killed, and 1 out of every 10 was injured! If the commission will merely quote these shocking figures to the wealthy corporations that are just now pestering them to extend the time set for equipping the cars with couplers and train brakes, they will surely have given a sufficient answer and rebuke.

#### THE SEVENTH INTERNATIONAL GEOLOGICAL CONGRESS—THE CAUCASUS EXCURSION.

BY E. O. HOVEY, PH.D.

In the minds of most of the members of the congress the geological excursion to the Ural Mountains before the sessions at St. Petersburg and to the Caucasus region afterward formed an integral and very important part of the whole, for by means of these excursions geologists from all over the world have been enabled to obtain a very good general idea of a great region which is usually very difficult of access for travelers. When the sessions of the congress in St. Petersburg closed some two hundred of those who had been in attendance went to Moscow to take part in the excursion to the southern part of the empire. Three days were devoted to studying the geology in and near Moscow; the hill on which the Kremlin stands, the Sparrow Hills (from which Napoleon watched the entrance of his army into Moscow) and Miatchkovo, a place noted for its Carboniferous fossils, being the localities visited.

From Moscow the geologists went southward in three parties by routes offering different points of attraction. One section went by way of Nijni Novgorod, and down the Volga River by steamer to Tzaritsyn or Astrakhan and Petrovsk and thence by rail to Wladikavkaz. This party had an interesting view of the geological section from Carboniferous to lower Tertiary along the right bank of the river, as well as of the phenomena of the great river itself and of the ethnological features shown by settlements along it. Another party went to Kiev and through the Dnieper valley to Kherson, traversing a region of special interest to students of Tertiary strata. The third and largest section visited Kharkow and the Donetz basin, and went thence to Wladikavkaz. This last group saw more mines and traversed a region more varied geologically than either of the others and will therefore receive the most detailed description in this account.

After leaving Moscow the first stop was made September 10, at Podolsk, to examine the great quarries of the cement works located there. The strata worked are of upper Carboniferous age, covered by about ten feet of morainic clay, and are put to various uses. The clay furnishes the red bricks which are the principal material of construction used in Moscow, and a heavy bed of fossiliferous yellow lime, capable of high polish, is used for stairways and ornamental purposes.

Some of the horizons consist of almost pure carbonate of lime, which, mixed in certain proportions with the clay, produces a Portland cement, while the dolomitic (magnesian) marly layers are mixed with the clay for the production of a Roman cement.

After leaving Podolsk, a few hours were spent in the important manufacturing city of Toula, and the party went, on the same afternoon, to the Petrovskofe coal mines, about ten miles from Alessine.

Three beds of coal, which occur in the lower part of the lower Carboniferous series, are exploited here, and some beds of pure quartz sand, also of lower Carboniferous age, are about to be used in a glass factory, now in process of construction near by.

This was the last place in the Moscow basin visited by the party, which then proceeded to Kharkow, where the study of the Donetz basin was begun in the geological museum of the university. Magnificent banquets were tendered the excursionists by the university and the city, which were but two of the series of fifteen banquets given this group of geologists while on their way from Moscow to the mountains. While these banquets were an expression of the unbounded welcome given the foreigners by all classes of Russians, they did not greatly assist in the study of the geology of the region. Between forty and fifty general banquets were tendered the geologists during their stay in Russia.

Kharkow is one of the most important cities of southwestern or "Little" Russia, and contains a university, a technological institute and two high schools.

Two days were spent in studying the coal fields of the Donetz basin and a mercury and a salt mine located in the same region. The Carboniferous rocks of this basin are divided provisionally by Messrs. Tschernychew and Loutougin, of the Geological Survey, into a lower, a middle and an upper section, the workable beds of coal lying in the middle section and the lower part of the upper section, the best being in the upper part of the middle series. The basin of the Donetz bears much closer analogy to the coal-bearing area of our central west (Iowa, Missouri and Illinois) than it does to the areas of western Europe, according to the Russian geologists. The Paleozoic section of the Donetz presents a complete series from the Devonian through the Permian into beds of indubitable Jurassic age, and in addition to the mines of coal, mercury and salt already mentioned, the rocks contain deposits of gold, silver, zinc, lead and iron which are being exploited.

The coal industry is by far the most important, there being about 10,000 square miles of exposed coal-bearing strata and a still larger area which is covered by later deposits. The geologists examined the Carboniferous section near the stations of Wolynsewo, Gorlovka, Almaznaia and Warwaropol and the upper works of some of the coal companies. Gas and coke coals and some anthracite are produced. The best beds of gas and coke coals are in highly inclined strata, but those which are nearest the axis of the main anticlinal contain the lowest percentage of volatile constituents and grade into anthracite.

The veins of cinnabar (sulphide of mercury) were discovered in 1879 by A. Minenkow, a mining engineer. They are situated near Nikitovka and are in the zone of the main anticlinal just mentioned. Those which are actually exploited occur in three minor folds. The most important is known as the "Sophia." The belt extends in an east-west direction and the veins end within the tract of land owned by the company. The ore occurs in the joints and crevices of a gray quartzite and impregnating a sandstone. Where the rock has been slickensided the cinnabar also is often seen to have been polished by the friction. A noteworthy association is the occurrence of irregularly disposed seams of coal or carbonaceous material together with and even inclosing cinnabar. The Russian geologists hold that the carbon has acted as a concentrator of the mineral. The cinnabar occurs in crystals and in massive form. The chief associated mineral is stibnite (sulphide of antimony), but pyrite occurs in some of the nearby strata. The present prosperous condition of the mine is due to the skill of Mr. A. Auerbach, of the firm of Auerbach & Company, who took the property a few years ago, when it was almost bankrupt. Last year the product of the works was 20,000 flasks of refined quicksilver, and this year it will be still greater.

The last mine visited in the Donetz basin was the great salt mine at Dekonskafa, near Bakhmout. The upper Permian strata of the Donetz are composed of clay, red and green marls and friable sandstones, to which are subordinated gypsum, anhydrite and rock salt. The series corresponds, in part at least, to the lower red beds of the Permian of eastern Russia. In the Donetz basin the Permian beds occur only in the western part, where they border the principal area of Carboniferous beds or emerge in isolated islands from beneath more recent rocks. For many years salt has been produced at Bakhmout by evaporating brines, but it was not until 1874 that the rich beds of rock salt at Detonskafa were discovered in a boring put down according to the suggestions of two Russian geologists, Messrs. Karpinsky and Erofejew. Between the depths of 255 feet and 765 feet (the bottom) nine beds of rock salt with a total thickness of about 340 feet were pierced. The level visited by the party of geologists is about 500 feet below the surface. The mine consists of vast chambers cut in Nos. 26 and 27 of the bore section. The combined thickness of these two beds is more than 123 feet, the upper six feet of which is interstratified with gypsum. The salt usually presents the appearance of a granular white mass, but

one often meets with large nests of perfectly transparent crystals and there are many cavities containing mother liquor. The salt is extracted by blasting, and the arched chambers thus left are impressive on account of their size and height and beautiful with their glistening white walls lighted up with the electric lamp as usual, or illuminated with red and green fire, as was done for the benefit of the geologists. Active mining here was begun sixteen years ago, but the development of the industry has been so rapid that the present annual production exceeds 16,000,000 pounds (262,000 metric tons).

After leaving the Donetz basin the route lay across the broad flat plains surrounding the Sea of Azov to the northwestern foot hills of the Caucasus range, where most of the party visited the warm and cold mineral springs at and near Piatigorsk and Kislowodsk. The waters are sulphurous and carbonated and have great reputation among the Russians, who have made a health and pleasure resort of the region. A small number of geologists who were specially interested in petroleum went to see the oil wells at Grozny instead of visiting the mineral water region, and another small section were left behind at Kislowodsk to make an excursion into the region near Mount Elbrus.

The drive over the famous Georgian military road from Wladikavkaz to Tiflis was inspiring on account of the wild grandeur of the mountain scenery and interesting to geologists, especially the petrographers, on account of the igneous rocks which were encountered during the first half of the ride. On the southern side of the mountains the road led for miles along the side of a canyon-like valley, the depth of which was more than 4,000 feet.

From Tiflis side excursions were made to the mineral springs at Borjoom, the Tertiary coal mines of Tkwi-bouli, and the monastery of Ghelati by some of the geologists, while the managers were waiting for all to come over the mountains. Then two days were spent in the Baku oil region on the Caspian Sea. So much has been written about this region that the readers of the SCIENTIFIC AMERICAN will not care for a detailed description of it here. The refineries of the Nobel Brothers and the wells at Bibi-Eibat, Balakhany, and Sourakhany were the objective points of the visit of the excursionists. Much of the oil is still lost by evaporation from the open reservoirs into which many of the wells discharge.

On leaving Baku the great body of the geologists went directly to Batoum and there took a special steamship for the Crimea, where about a week was spent in examining the volcanoes, volcanic rocks, and sedimentary deposits of that historic peninsula from Kertch to Sebastopol. The official close of the grand excursion took place at the latter city on October 5, and at Odessa the geologists scattered to their respective homes. A party of about thirty-five separated themselves from the rest at Baku, and, leaving the railroad at Akstafa, took carriages for a side trip into Armenia, the ascent of Mount Ararat being the main object of the excursion for most of the participants. After leaving the broad plain of the Kura River, the road traverses a short section of Cretaceous and then enters the great fields of lava, which cover an immense area in Russian Armenia and stretch to undetermined distances in Persia and Turkey. The literature on the region is very scanty. The drive of one hundred and twenty miles to Erivan was made in two days of hard work, but many items of interest to petrographers were picked up en route, while the scenery is very fine. At Erivan the party divided up somewhat, twenty-eight going on to Ararat and the others disposing of themselves in various ways.

The Ararats are great volcanic cones which have suffered much from erosion. Augite-andesite constitutes the mass of Little Ararat and most of Great Ararat, but basalt occurs on the northwestern flank of the latter. The snow cap prevents the determination of the existence of a summit crater on Great Ararat, but there was such a crater on Little Ararat. Neither cone presents any great mountaineering difficulties to an ascent; success is a question of endurance, perseverance, and proper preparation.

Before going to the mountain the party spent a day in visiting Etchmiadzin, the headquarters of the orthodox Armenian church; and after returning from Ararat the journey led over the lava-strewn plain at the base of Mount Alighenz to Alexandropol and out to Ani, the ruined capital of ancient Armenia, which stands on a bluff made up of a series of beds of interesting volcanic tuffs. From Alexandropol the party returned to Dilijan over a part of the route of the Kara-Tiflis Railway now building, and thence to Akstafa, where the train was taken for Batoum, and the Ararat party followed their predecessors to the Crimea and out of Russia, sorry to leave a country where they had met only friendship and unbounded hospitality from everyone, from the Czar to the meanest peasant, for nearly three months, and had learned much of great geological interest, while viewing beautiful scenery and seeing some of the many different tribes and nations that constitute the Russian empire.