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THE ISONZO FRONT IN THE FIRST WORLD WAR: GLASS AMPOULES FOUND IN THE VICTINITY OF THE VILLAGE KRED

FRONTA UZ SOČU TIJEKOM PRVOG SVJETSKOG RATA: STAKLENE AMPULE NAĐENE U BLIZINI SELA KREDA

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Summary

Objective: To identify the contents of ampoules stored items at the WW I Kobarid Museum, Slovenia. Sources and methods: Analysis of ampoules from the Kobarid Museum using pharmacopoeial methods. Results: The contents of the unlabelled ampoules were identified as calcium hypochlorite, a decontaminant for mustard gas (Yperite). Conclusion: The Isonzo front/Soška fronta was opened on May 24 1915 by the Kingdom of Italy according to a secret London Treaty. In exchange for the opening of this front, the Kingdom of Italy would be granted large tracts of territory in the wesster provinces of the Austro-Hungarian Empire and along the Adriatic coast. The ensuing trench-warfare during the eleven Isonzo battles ended with the 12th battle known as the Kobarid/Karfeit/Caporetto break-thru in October 1917. The joint German and Austro-Hungarian forces waged a massive gas-attack with dichloroarsine and phosgene, which was later disclosed as the horrifying overture to the general disordered retreat of the Italian troops to Piave. The possibility of a chemical attack was underestimated by the Italian high command as shown by the ineffective gas-masks issued to the troops. Hovewer, a recent find of ampoules with calcium hypochlorite at the village of Kred, now exhibited at the Kobarid WWI Museum, leads to the conclusion that the Italian IVth army's command, located in Kred, considered decontamination measures against Yperite necessary.

Key words: *First World War; Isonzo/Soška front; Caporetto/Kobarid break-thru; gas-war; calcium hypochlorite; Yperite.*

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Introduction

The Isonzo front (Soška fronta) in the First World War was opened on May 1915 according to the provisions of the secret Treaty of London signed on April 26. 1915 by the allied governments of Great Britain, France, Russia and the Kingdom of Italy. Italy was promised extensive territorial gains in the Austro–Hungarian countries (Tyrol, Litoral including Trieste, Istria, part of Dalmatia including most of the Adriatic insulae and a large part of Creina) for siding with the allies and starting military operations against the Austro-Hungarian Empire from the Dolomites to the estuary of Isonzo (Soča). A front approximately 600 km long. In the southern part of the front, military action was carried out along the Soča river and its sorroundings in the ethnical Slovenian territory [1].

The outnumbered Austro-Hungarian forces withdrew to positions on the left bank of the Soča. The Italian armies under the command of General Luigi Cadorna crossed the state border. However, their attempts to conquer Trieste/Trst, to take hold of the central part of the Doberdob plateau, and endanger the "Ljubljana gate" were not successful. The Italian Military lost their momentum and the result was trench warfare in the mountaineus regions of the Dolomitic and Julian Alps and along the Soča river.

The mountains on both sides of the river were fortified by numerous caverns that hid artillery and infantry. The stalemate was especialy burdensome to the Austro-Hungarian side because of the loss of men and material in Bessarabia and the Balkans. The Italian side, on the other hand, received material help from its allies. The Austro-Hungarian war material production was grinding to a halt due to a lack of manpower and material. The metal shortage was especially acute even after the church bells, copper roofing, and even bronze mortars from pharmacies were confiscated! [2].

The eleven battles of the Isonzo front resulted in heavy casualties on both sides with minimal gain in strategic terrain.

The Austro-Hungarian forces along the Soča, commanded by General (field marshall) Svetozar Borojević de Bojna, should have undertaken the offensive, but lacked the neccessary resources to do so. The aid requested from their German ally was promised with reservation; after a mutual inspection of the Italian fortifications in the upper parts of the Soča valley. Field-marshal Borojević's plan to attack in the Kobarid (*Karfeit, Caporetto*) region by moving troops through the Soča valey from Bovec was possible only by employing the chemical weapons against the Italian artillery caverns. Extensive preparations for the joint Austro-Hungarian and German 14th Army assault started in the summer of 1917. More than 2400 train loads of material and additonal troops were moved into the region. In September 1917, the Axis army was ready to strike. The Italian side was well informed about their activities, however, they and their allies considered Italian positions to be safe and indestructible.

V. Klavora in his book Plavi križ/Blue cross [3], provides a detailed description of the gas attack in the Kobarid and Bovec regions. There is scarce written data on the chemical warfare agents used in the Kobarid strike (the 12th Soča battle). The information that is known comes from past and recent funds of gas mines and artillery shells as documented by Klavora. Photographs and a written report by two Austro-Hungarian artillery officers who witnessed the deadly results immediately after this attack are included as supporting evidence of what occurred.

It is estimated that 111,000 gas artillery shells of German origin were fired during the attack; some of them are still being recovered, today, from this site [3].

The institution Kobariški muzej (Figure 1) exibits among numerous items from WW I 35 glass ampoules found by a farmer that was plowing in the victinity of Kred (Figure 2).

Figure 1 - Kobarid, museum building

Slika 1. Zgrada Muzeja u Kobaridu

Figure 2 - Ampoules found at Kred

Slika 2. Ampule pronađene u Kredu

The Italian IV. Army's corps (IV. Corpo d'armata under general Cavaciocchi) headquartes were located at the village of Kred in the Kobarid municipality [4].

In 2009, Mr. Željko Cimprič, the director of the Kobariški muzej asked me to assess the nature and use of the ampoules [5].

The find is connected with the above military preparations in the autumn of 1917.

Experimental work

The ampoules are made from colourless glass and without any identifying markings. The contents of the ampoules consists of a white free-flowing powder that has partialy become monoclinic crystals. (Figure 3)

The dimensions of the ampoloues are 6,8 cm in length with a diameter of 0,8 cm with a breaking line in the middle. One side bears sealing tracks. The ampoules were prepared by cutting appropriate lenghts of glass tubes, which were gas-flame sealed on one side. There were most likely filled by using a

Figure 3 - Ampoules, close-up

Slika 3. Ampule, iz bliza

some type of funnel, which most likely was folded parchment paper. The filled ampoules were immediately sealed. The appearance and manipulation tracks indicate the experimental approach instead of being prepared like the injectable liquid pharmaceutical ampoules of the time.

The dirt that was adhearing to the ampoules was removed. An ampoul was weighed and found to have a mass of 3.819 g. The ampoule was opened by breaking on the breaking line, with full personal protection on, and immediately the typical hypochlorite smell was observed. The net mass of the white powder was 0.507 g

The white powder could be an inorganic hypochlorite or chloramine T.

For consistency with older analytical techniques, the following identification reactions were performed acccording to the Pharmacopoeia Jugoslavica II. [6]. 0,495 g of the analyte were suspended in 6 ml of distilled water: the supernatant was used as described:

1. three drops of the supernatant and 3 drops of potassium iodide R were mixed in a test tube: immediately a brown yellow collour appeared due to the transformation from potassium iodide to elemental iodine.;
2. to the above brown yellow liquid 3 ml of chlorofom were added, mixed, and allowed to separate. The lower violet blue layer indicated the presence of iodine;
3. one drop of supernatant 1/ on red litmus paper showed a blue alkaline reaction and immediately turned pale leaving a white spot. The above results indicate the presence of an oxidant, possibly one of the hypochlorite salts or chloramine T;
4. the supernanant was treated with diluted hydrochloric acid R. A greenish gas evolved (chlorine) and at pH 1 no deposit was formed: p-toluenesulfonamide is therefore not present. Thus, the presence of chloramine T was excluded;
5. 2 mL of supernatant was alkalinized with concentrated ammonia and upon the addition of 2 mL of saturated ammonium oxalate solution copious amounts of a white crystalline mass (calcium oxalate) was produced. The reaction indicated the presence of calcium ions.

The analyte corresponds to all PH.JUG. II identification reactions for the article Calcaria chlorata (calcium hypochlorite).

The Assay [6] could not be performed with the 4g of material recommended as this was not available. The remaining 0,4 g of material from one ampoule was suspended in 200 mL of water, upon the addition of 1g of potassium iodide acidified with hydrochloric acid, and the eliminated iodine titrated with 0,1 m sodium tiosulphate against soluble starch indicator. 28 mL of titrant were consumed, indicating at least 25 % of available chlorine.

Possible intent of use and comments

Hypochlorites have been used in medicine since their discovery. Calcaria chlorata, natrium chloratum, and kalium chloratum (Eau de Labaraque and Eau de Javelle, sodium resp potassium hypochlorites, dissolved in water and perfumed) were used for bleaching, deodorizing and desinfection.

During WWI, there were numerous wounded soldiers with deep lacerations and pockets favoring infections and reinfections.

The English surgeon, Henry Drysdale Dakin, suggested applying solutions of sodium carbonate and calcium hypochlorite that were filtered and then buffered with boric acid to these wounds. The technique of constant washing/ spraying of the wounds produced very good results. Thus, diluted solutions, usualy 2% strenghts of hypochlorites, were in daily medical use.

Modern research has found bactericidal effects with 0,25% sodium hypochlorite albeit with toxic effects and delay in burn wound healing. 0,025% solutions exibited the batericidal effect without impeding wound healing [7].

The carefully ampullated, but not labelled, calcium hypochlorite suggests the possible search for antidotes in the impeding chemical war.

Soldiers at the Soča front experienced the first gas atack on the Doberdob plateau: Austro-Hungarian forces released chlorine from steel cylinders in August 1916. The Italians were without any protection and even the attacking troops were poisoned by backdifusion of chlorine. Gas masks were provided only for those that worked directly with the gas cylinders.

The Italians later retaliated by igniting kerosine before the Austro-Hungarian caverns with the defenders, mostly Dalmatians, being poisoned by the smoke during an attempt to capture the important positions on mount Sabotin above Gorica [3].

Chemical warfare on the Western front began in Belgium in December 1915. German forces used the asphyxating gases: chlorine, dichlorocarbonate (phosgene), trichlorometil formiate (diphosgene), and later vesicant compounds known as Lost agents, named after Lommel and Steinkopf, the chemists who developed the industrial synthesis of 2,2'-dichloroethyldisulfide for military production.

This compound was used as a surprise agent against the Entente forces at Ypres on July, 12, 1917; hence the name yperite (also yellow mustard gas due to its colour and sulfidic smell). In German military designation HS, Gelbkreutz. Hypochlorite solutions were soon deployed as decontaminants for equipment and personel.

The pure compound was synthesised in 1886 by Victor Meyer; he experienced and described the painfull serum filled blisters, while working with this substance. In the victims at Ypres, leucopenia and bone marrow aplasia were observed at a later date. The insidious poison acts by conversion to ethylene episulfonium ions, the actual alkylating agent.

Military research in structure-activity properties of sulfur and nitrogen vesicants (S and N Losts) in the USA was opened to the research community in 1946. The idea, based on toxic manifestations in Ypres victims, was to retard the growth of the cancer cells. The American Cancer society supported the research leading to the first alkylating type cytostatics usefull in some cancers; a small benefit from the misuse of science [8].

Immediately after the first gas attacks, a feverish search ensued for preventive and antidote measures. Adapting the masks used in mining was successful. Protection against asphyxating gasses (pulmonary oedema- inducing compounds) was relatively good, albeit effective only for short term exposure. [9]. (Figure 4)

Sternutators (irritants) diphenylarsine (Clark I) and diphenylarsincyanide (Clark II) were introduced as »mask breakers«. Arsine aerosol (smoke) delivered by shells, marked with a blue cross (Blaukreutz), provoked violent sneezing, coughing, tearing and eye- burning thus forcing the bearer of simple masks to abandon their protection against the concomitantly employed nonirritating, but lethal, phosgene [10].

The Italian command underestimated the danger of chemical warfare in the Soča battlefield. Possibly they believed in the protective virtues of their gas mask "Mashera polivalente". However, the inadequate composition of the filter cartridge and of the materials that composed the face mask rendered it practicaly useless [3].

The introductory shelling of Italian positions in the 12th Isonzo offensive consisted of both Clark I (Blaukreutz) and phosgene (Grunkreutz) projectiles that had a devastating effect. Gas-mines were released at Bovec/ Flitsch at the Koritnica and Soča confluence; artillery caverns on both sides of the mountains flanking the course of the river were atttacked with gas-filled cannnon shells, starting at 2 a.m. on October 24, 1917. Italy suffered cca 55, 000 non-lethal and 4,627 dead soldiers that were victims of gas attacks during WW I. A majority of these casualties occurred during this attack [9].

Some sources indicate that possibly mustard gas (Yperite) was also used in this offensive. However, the research by V. Klavora does not support this possibility and considering that the first attack with mustard gas at Ypress in Belgium ocurred in July 1917 [3].

Yperite is a yellowish oily lipophyllic liquid (m.p. 14 °C, b.p. 217 °C). At ambiental temperature, it does not appear in a gaseous state as the colloquial

Figure 4 - Gas-mask of German origin

Slika 4 . Njemačka plinska maska

name mustrad gas suggests. Protective measures require, as known today, impermeable total body protection with an integrated face mask. All contaminated surfaces should be mechanicaly cleaned by imbibing the oily droplets with soft paper or other soft absorbing material.

The residue should be destroyed by applying a water slurry of calcium hypochlorite. Dry calcium hypochlorite must not be applied to Yperite as this results in an exothermic reaction and might possibly ignite.

The alkaline and oxidative reagent hydrolysed and oxydized dichloroetildisulphide to less toxic components. Hovewer, chloramine T (p-toluenesulfochloramide sodium) is preferred for decontamination on skin as it leads to a non-toxic sulfimine derivative. Actualy, no antidote for absorbed (reacted) yperite is known [9].

Yperite was used in some recent conflicts. Large quantities of this agent were employed in the Iraq/Iranian conflict. The detection of stock piles of this agent, historical deposits, and their possible use in a terrorist attack continually generates publications on new decontamination agents, e.g. peroxocarbonates prepared in situ by combining sodium hydrogencarbonate and hydrogen peroxide [11] and micronized synthetic sodium calcium alumosilicates as adsorbents for example [12].

The hilly terrain on the Isonzo front was considered unsuitable for use of chemical gases. The command of the Italian IV army corps, hovewer, was informed about the then newest items of chemical warfare from both French and English sources.

The ampoules with high purity calcium hypochlorite at Kred might have been an attempt to inform the commanding officers about protective measures against the newest chemical warfare items of their time.

Ignoring the possibility of a war gas attack was in part due to the ruthless leadership of Luigi Cadorna who was known for commanding suicide attacks on Austro-Hungarian positions. It was also due to a lack of strategic foresight to recognize that the arrival of German troop's alos meant the arrival of the newest warfare technology to the Isonzo front (*Cover page*).

The breakthrough at Kobarid resutled in the rapid retreat of the Italian armies to Piave. Hovewer, the collapse of the oversterched supply routes and the general surrender of the Axis forces in October 1918 trapped the advanced Austro-Hungarian soldiers.

The dead and wounded soldiers and misery of civilians on both sides involved in the Isonzo battles seem to have been just an introduction to World War II.

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Povzetek

Soško bojišče v prvi svetovni vojni je v maju 1915 odprla Kraljevina Italija na osnovi določil skrivnega Londonskega sporazuma, ki je Italiji obljubljal obsežne ozemeljske pridobitve na račun zahodnih dežel monarhije Avstro-.Ogrske in pretežnega dela Jadranske obale. Italijanske armade so napadle na vsej dolžini zahodne kopenske meje, vendar načrtovanih osvojitev niso dosegle.

Pretežno stacionarna rovovska vojna je znana kot enajst Soških ofenziv se je končala s prebojem pri Kobaridu v oktobru 1917. Združene avstro-ogrske in nemške armade so tvegale koncentriran plinski napad s fosgenom in dikloroarzinom. To je bila strašljiva uvertira k splošnemu umiku italijanskih čet do Piave.

Možnost kemijske vojne se italijanskim komandam ni zdela verjetna. Odkritje neoznačenih ampul s kalcijevim hipokloritom v okolici vasi Kred, kjer je bila komanda italijanske IV armade, dovoljuje sklep, da so za obstoj iperita in ustreznega dekontaminanta vedeli. V ampulah, ki jih razstavlja Kobariški muzej smo identificirali kalcijev hipoklorit na osnovi farmakopejskih preizkusov.

Ključne besede: *Prva svetovna vojna; Soška fronta; preboj pri Kobaridu; plinska vojna; kalcijev hipoklorit; iperit.*

Sažetak

Cilj: *Identifikacija sadržine ampula iz zbirke predmeta iz Prvog svjetskog rata izloženim u Kobariškom muzeju, Slovenija.*

Izvori i metode rada: *Nesignirane ampule izvorom iz zbirke muzeja u Kobaridu analizirati farmakopejskim metodama i objasniti moguću upotrebu.*

Rezultati: *Sadržaj je identificiran kao kalcijev hipoklorit, dekontaminant za iperit.*

Zaključak: *Fronta uz Soču / Isonzo front započeta je 24. svibnja 1915. kada je Kraljevina Italija sukladno tajnom Londonskom sporazumu napala Austro-Ugarsko carstvo, da bi pridobila opširne teritorialne koncesije na račun Austro-Ugarskih zapadnih provincija i Jadranske obale. Rasplamsali rovovski rat je nakon jedanaest Soških bitaka završio dvanaestom, poznatom kao proboj kod Kobarida u listopadu 1917.. Udružene snage Njemačke i Austro-Ugarske su riskirale opsežan napad dikloroarsinom i fosgenom, što se kasnije pokazalo kao strahovita uvertira u neorganizirano povlačenje talijanske vojske prema Piavi. Mogućnost kemijskog rata na Soškom frontu talijanska komanda nije ocijenila ozbiljnom prijetnjom što pokazuje nedovoljna opremljenost plinskim maskama. Ipak nedavni nalaz ampula s kalcijevim hipokloritom u blizini sela Kred dozvoljava zaključak, da je tamo locirana Komanda IV. talijanske armade imala informacije o zaštiti od iperita.*

Ključne riječi: *Prvi svjetski rat; Fronta uz Soču; proboj kod Kobarida; kalcij hipoklorit; iperit.*