

Wollo-ri: Much Ado About Something

A counter-analysis examining known nuclear facilities and important civilian facilities reveals there are still many questions surrounding the site at Wollo-ri (also spelled Wonro-ri), and that a conclusion as to its purpose cannot yet be ascertained based on publicly available information.



On July 8, 2020, CNN [reported](#) on research done by experts from the Middlebury Institute of International Studies on a facility in the village of Wollo-ri (near Pyongyang) that claims the facility is part of North Korea's nuclear program and is likely involved in either warhead production or warhead storage.

Jeffrey Lewis and fellow researchers Catherine Dill, David LaBoon, and Dave Schmerler then published a more [detailed account](#) of their line of reasoning on the *Arms Control Wonk* blog. The post listed a number of visual signatures about Wollo-ri that led them to suspect the facility was part of the country's nuclear program. That suspicion was then bolstered by a mention in [Ankit Panda's](#) new book [Kim Jong Un and the Bomb](#), in which Panda says that the US intelligence community assesses that there is an undeclared nuclear facility in Wollo-ri. Having that public mention of the facility led to Lewis et. al going public with their own research.

After the reporting, a number of experts commented^A and gave the general view that there is nothing specific to Wollo-ri that would make it a suspected nuclear facility. I happen to agree.

However, there hasn't been a point-by-point counter-analysis of why some experts may disagree with the assessment by Lewis et. al. That is the purpose of this report.

Before I go on, I want to be clear that none of this should be construed to mean that Wollo-ri *isn't* a nuclear facility. It might be and it might not be. What I am attempting to show is that while the possibility exists, the *probability* of it is low based on the available evidence (especially whether it's a storage facility), and that more research needs to be done before coming to any conclusion.

In the *Arms Control Wonk* post, five points are listed to support the group's conclusion that this facility is likely an undeclared nuclear site. I would like to go through each of those points and give my reasoning for why I don't think they are necessarily, either individually or collectively, direct signatures of a nuclear facility.

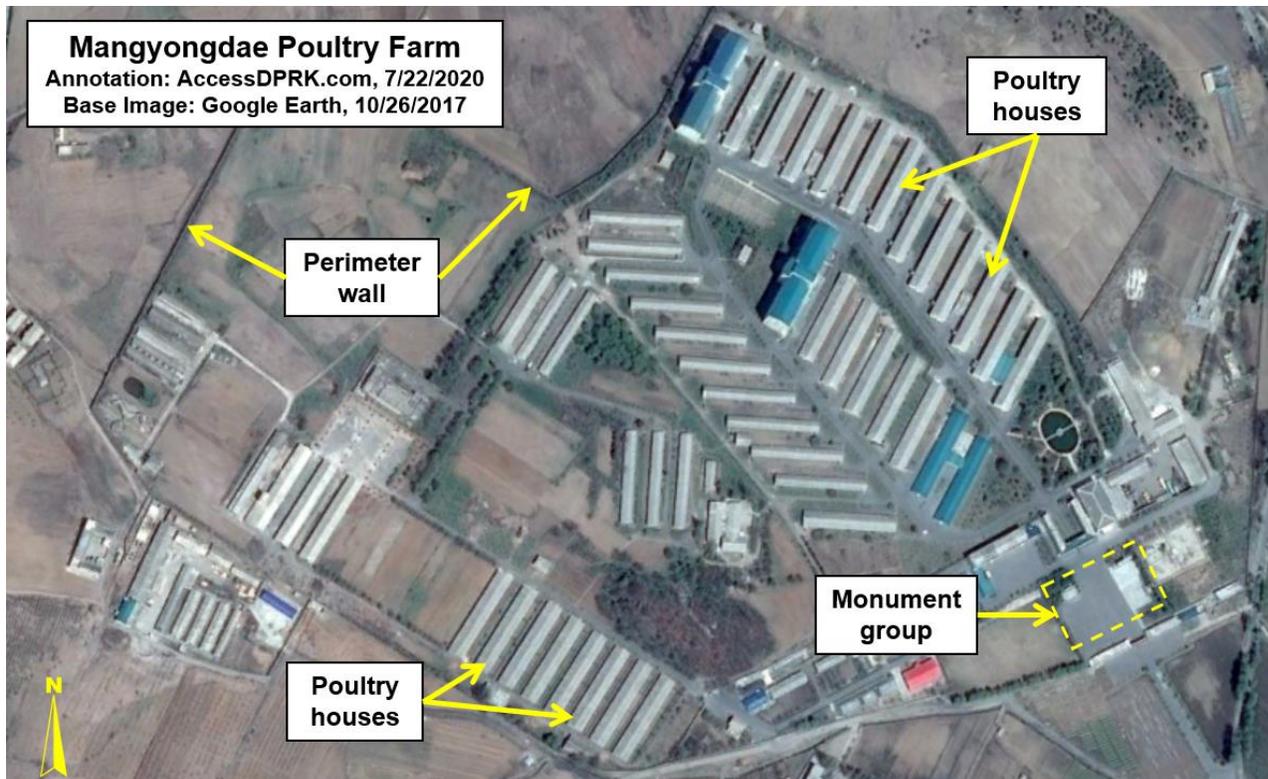
The signature elements described are:

1. A strong security perimeter
2. On-site housing
3. Monuments commemorating unpublicized leadership visits
4. The existence of underground facilities (UGFs)
5. Lewis also uses a description by US officials in September 2018 that talk about an undeclared warhead storage facility. The unnamed officials are [cited](#) as saying North Korea "*built structures to obscure the entrance to at least one warhead storage facility*" and that "*the U.S. has also observed North Korean workers moving warheads out of the facility.*"

On the security perimeter

The facility is surrounded by a wall that runs along the full perimeter of the site and is approximately 1,460 meters long. Lewis points out the fact that the nearby Ryongaksan Spring Water Factory doesn't have any such perimeter wall, and so the wall's existence helps to key us onto the fact that the facility is important.

Typically, this is true. Most civilian facilities lack a defined perimeter. However, many military sites lack them as well. In fact, few military sites have more than a guard post at the entrance let alone full perimeter security. There is even an artillery base located a mere 60 meters from Wollo-ri's perimeter that doesn't appear to be surrounded by anything; no wall, no fence, nothing.



And while most civilian sites lack a wall, some do have one. An example is the nearby Mangyongdae Chicken Farm (39° 2'47.29"N 125°38'44.50"E) which has its own 2.9-kilometer-long wall.

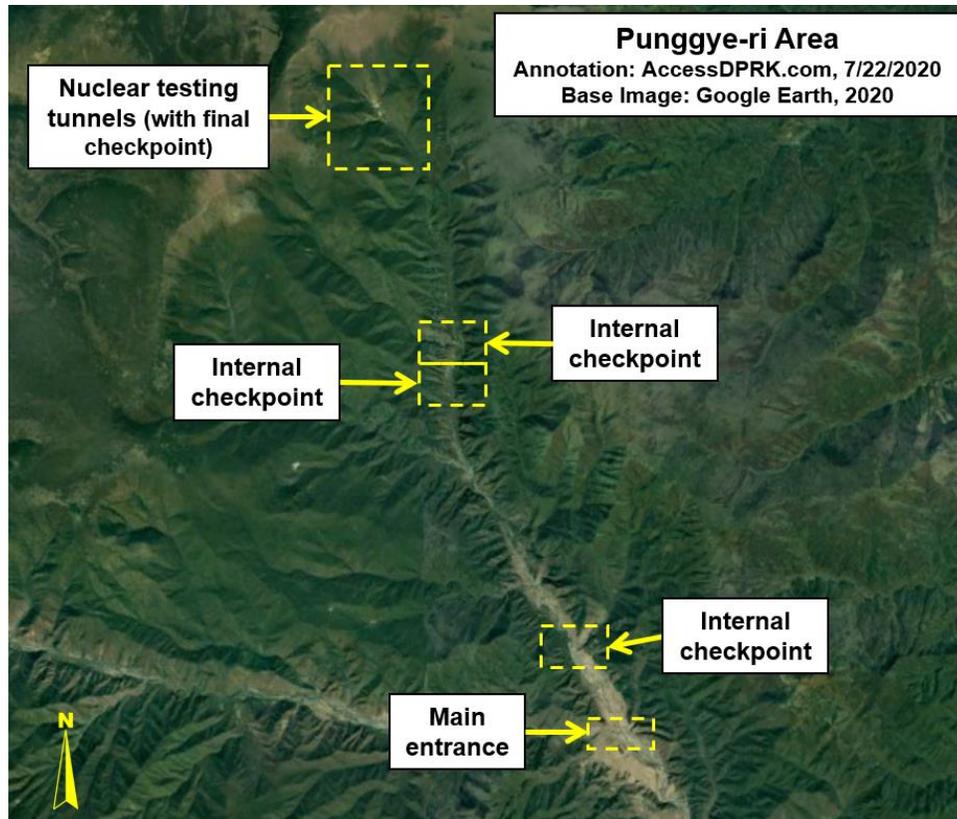
When examining known nuclear-related facilities, we do find that most have a perimeter wall. The [Pyongsan](#) uranium processing and milling plant has one, each of the laboratories and research compounds within [Yongbyon](#) have their own walls, and sites associated with their WMD/missile programs also have them like the Kim Jong Un National Defense University. But while looking at these places, a key difference between them and Wollo-ri becomes apparent.



The Wollo-ri facility has three entrances into the complex. There is a primary entrance at the southwest corner and then two others along the eastern portion of the wall. Every other known and suspected nuclear facility only has one direct entrance, including the [suspected uranium enrichment](#) site at Kangson which Lewis described in 2018.

The entrances at Wollo-ri are also fairly basic and do not appear to include anything substantial blocking the entry points, just small guard huts. No gate or movable fencing to impede forced entry.

Having multiple entry/exit points raises the security risk that something could be stolen. And having multiple sets of guards raises the risk that someone could be bribed to let in an unauthorized person(s).



Facilities like Yongbyon and the Punggye-ri nuclear test site, where substantial nuclear components and functional nuclear devices are held, take a multilayered approach to security. To get to the actual testing tunnels at Punggye-ri, one has to travel along [several kilometers](#) of narrow road and make it through multiple checkpoints. If Wollo-ri is where nuclear warheads are either being produced or stored, only the strictest security measures make sense.

Of on-site housing

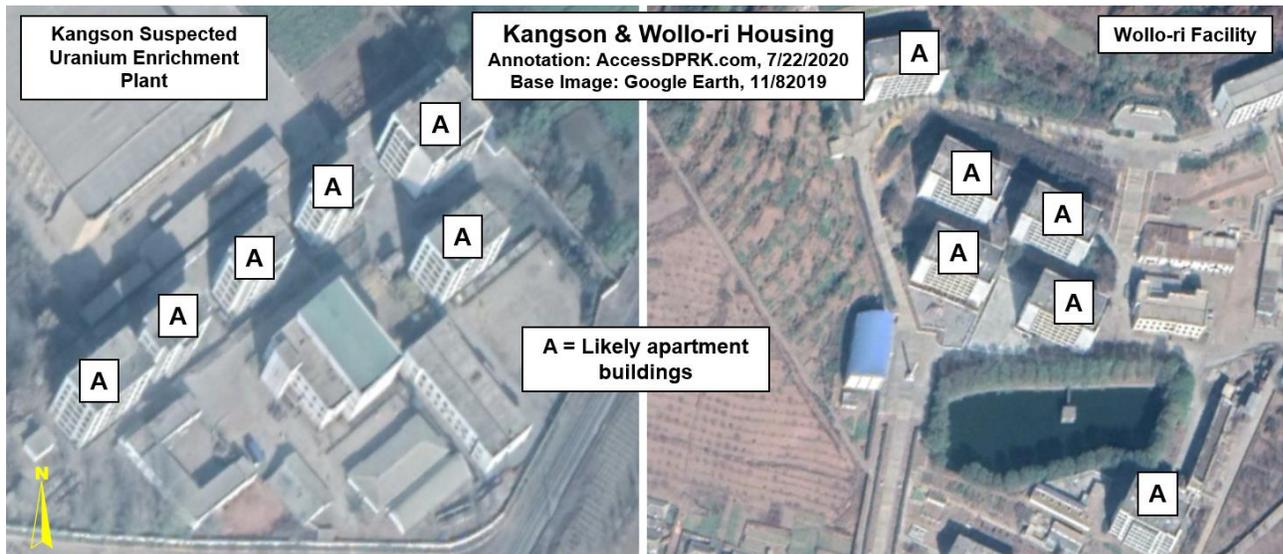


Image showing apartment buildings ("A") at both Kangson and Wollo-ri.

Using Kangson as an example, Lewis cites what are likely apartment blocks within the perimeter as evidence that the facility may be part of the country's nuclear program because having on-site housing (within a walled complex) is quite rare, and Kangson also has on-site housing. On-site housing is indeed unusual in North Korea but most nuclear facilities, in fact, do not have such an arrangement. Neither the Pyongsan or Pakchon uranium milling plants have housing, Yongbyon is a closed city with a defined housing district but no housing within the individual research and production areas, and the Academy of National Defense Science (Sanum-dong) lacks it as well. Other sites may have housing but part of that is due to the expansive size or remoteness of the facilities in question.

To be short, on-site housing at any facility would indicate it has some level of importance, but it is not a unique identifier of nuclear facilities.

Another thing to consider is how the housing relates to Wollo-ri's potential purpose.

Wollo-ri lacks any obvious substantial electrical infrastructure which would point to the existence of energy-intensive industrial activity or to a large underground facility. When the site at Kangson was constructed, an electrical substation was built nearby as well to help provide the needed electricity. Lacking its own substation or major transmission lines, this would suggest that whatever is going on at Wollo-ri wouldn't be intense industrial activity or producing large numbers of parts.

At the same time, there are six apartment blocks at the facility. I estimate that there are as many as 406 apartment units^B; each given to a worker and their family. Assuming some couples work together, let's make it an even 450 employees.

North Korea's nuclear inventory has less than 100 warheads and it is estimated that they can produce no more than twelve bombs per year at maximum output. The country already possess an industrial base known to produce a range of electrical components for their ballistic missiles and other weapon systems, and more dangerous components (like the explosive lenses) are manufactured elsewhere, so an undeclared production facility would likely be used in the production of specialty parts. But you wouldn't necessarily need 450 employees to produce a handful of small devices each year.

The monuments

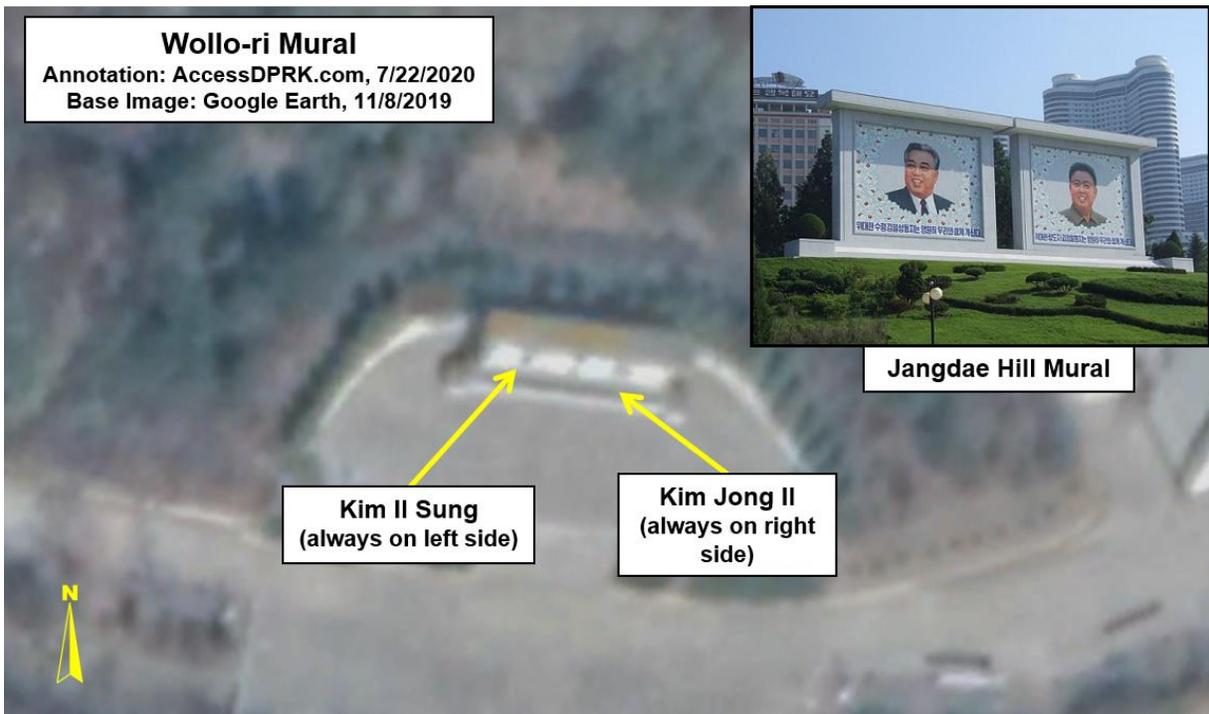
Monuments can be an indicator of the importance of a facility. Whether it educational, industrial, agricultural, or military, the type of monument(s) seen at a site can help give a fairly unambiguous ranking for the place. They can also indicate if Kim Jong Un (or his predecessors) has visited before.

Wollo-ri possesses two monuments: a Tower of Immortality and an apparent joint mural of Kim Il Sung and Kim Jong Il.



A typical example of a Tower of Immortality.

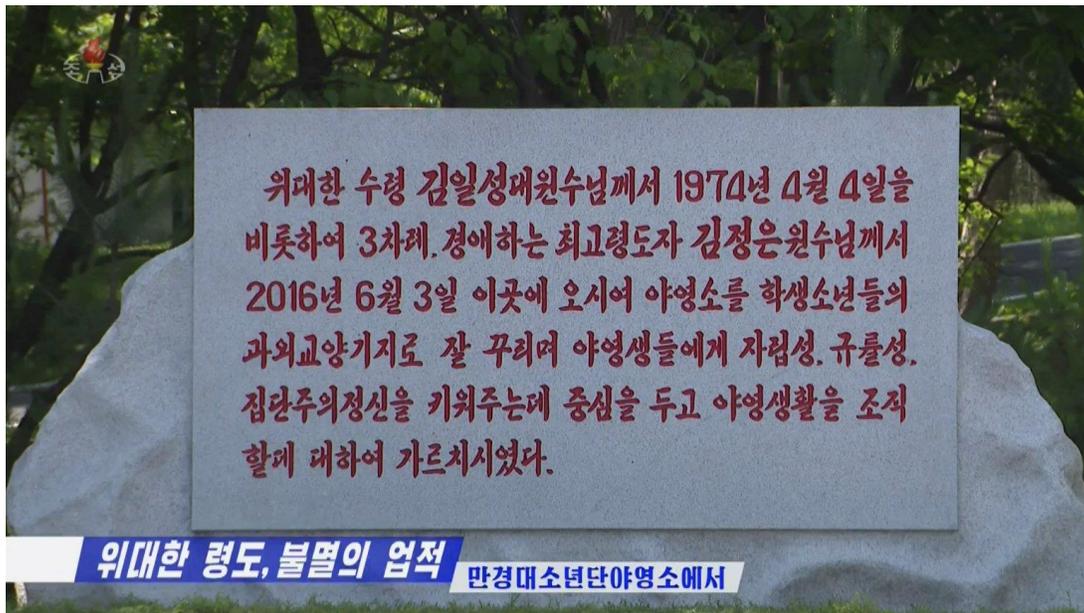
Towers are found in every town in the country and they are dedicated to the “eternal” lives of Kim Il Sung and Kim Jong Il. They can also be found at universities, factories, and other sites the regime deems worthy. During my [2019 survey](#) of North Korean monuments, I found at least 5,175 Towers across the country.



Joint murals are found in county seats and at even more rarified civilian and military facilities.

In some places you can clearly see the faces of the Kims through satellite imagery. Unfortunately, the mural view at Wollo-ri isn't the greatest quality. But what is obvious is that there are two images being shown (interpreted as busts of the Kims) and the rest of the monument's surface appears to be white. This is indicative of a joint mural. Unlike the thousands of Towers, fewer than 300 were identified during the monument survey.

The existence of the mural at Wollo-ri is important, however, it isn't a signature of a nuclear facility, even when combined with the Tower. The [headquarters](#) of North Korea's air force has at least seven monuments and a joint statue of Kim Il Sung and Kim Jong Il, the highest honor any North Korean site can be bestowed. The headquarters also has a defined perimeter and on-site housing.



Monument at the Mangyongdae Children's Camp commemorating visits by Kim Il Sung in 1974 and Kim Jong Un in 2016. | Screenshot provided by Colin Zwirko.

In the *Arms Control Wonk* post, it is claimed that the monuments at Wollo-ri indicate visits to the facility by the country's leadership. That is simply incorrect. As I have described, Towers and joint murals are found in many locations and none are directly connected to leadership visits, rather, they are daily reminders of the [Kim family cult](#) and (when taken in combination) can ascribe a level of importance to a given site. Commemorative monuments are much smaller and are typically rectangular blocks of stone with a brief inscription carved into the surface.

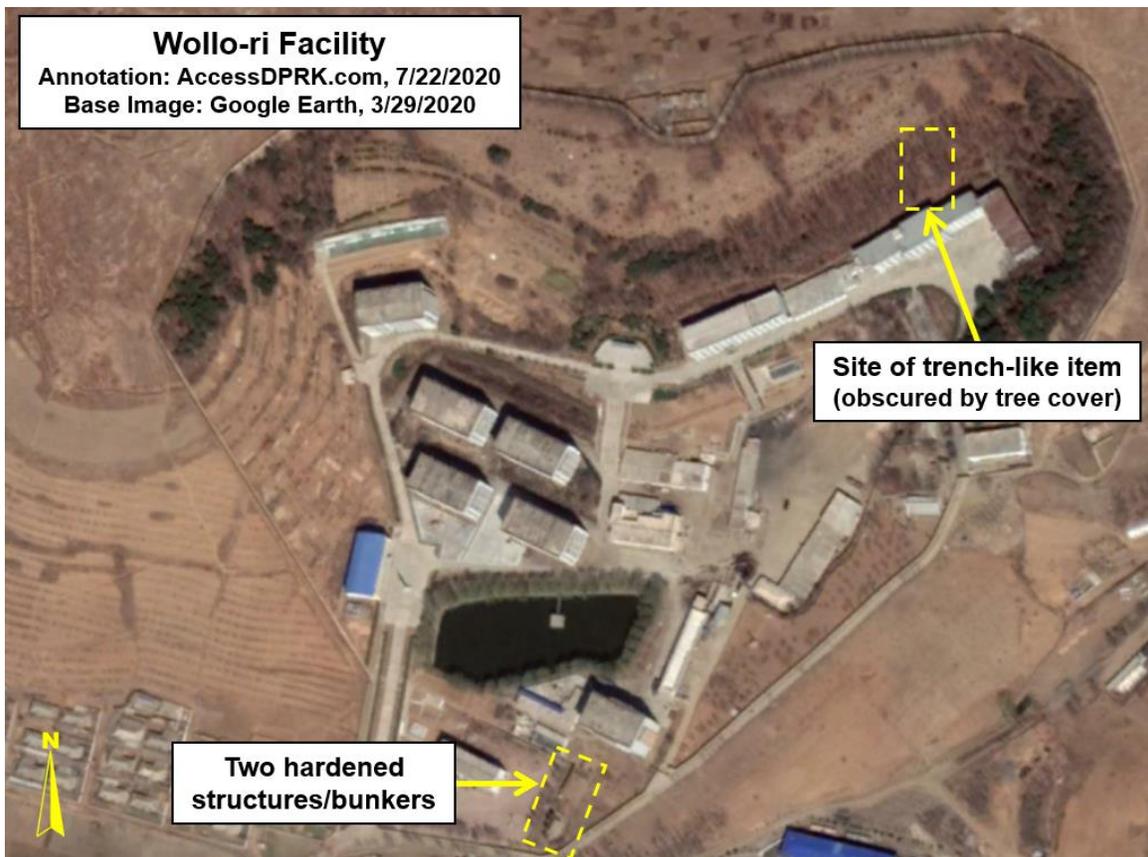
These can be found at many (but not all) places visited by the Kims. In the event of multiple visits, instead of having an ever-growing wall of monuments, a museum will be built. This was the case with [Korean People's Army Farm No. 1116](#) which has received annual visits by Kim Jong Un since 2013. Even if visits to Wollo-ri weren't publicized, the facility would still be awarded with a monument.

Wollo-ri only has the Tower and mural.

Underground facilities

In the most simplistic terms, an underground facility (UGF) could be defined as any useful structure with an inch of dirt placed on top. However, most wouldn't consider a root cellar or simple basement a genuine underground facility. Particularly for the purpose of secure and clandestine manufacturing or storage, underground facilities are located multiple meters below the ground if they are placed underneath an existing building or they are excavated deep into hills and mountains.

North Korea probably has more identified underground sites than any country on earth. Some are enormous arms production facilities (like the Kanggye General Tractor Plant, the largest known underground arms manufacturing plant in North Korea) and others are smaller facilities used for storage or that sit empty until needed in the event of a conflict. They are all clearly identifiable once you know what to look for.

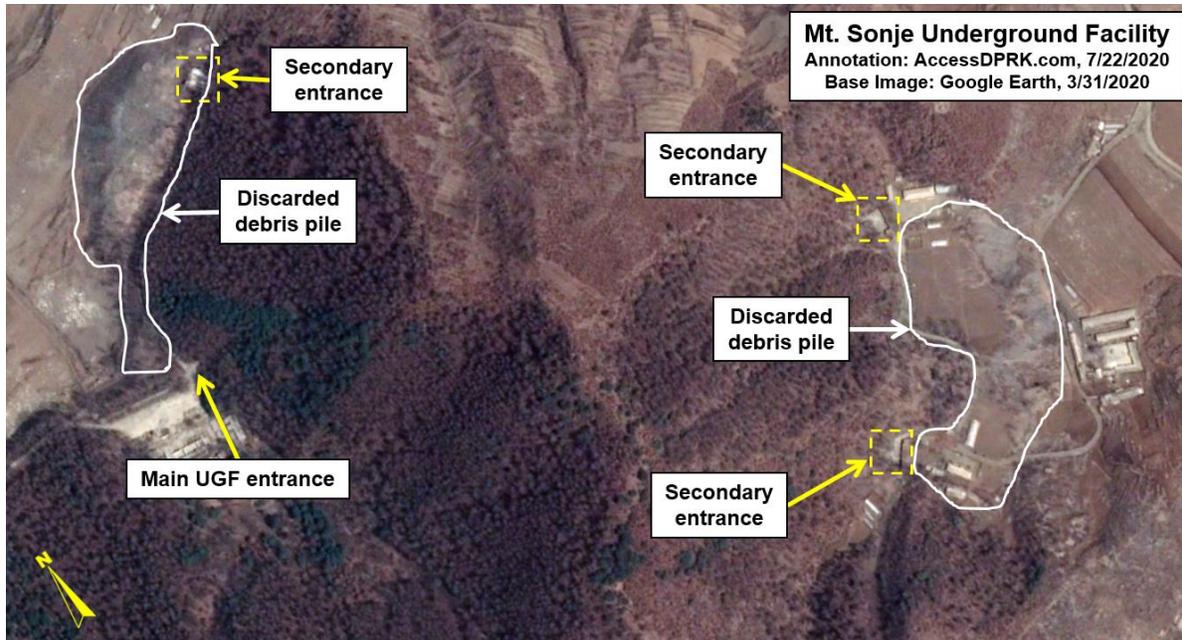


There are two hardened structures at Wollo-ri at the front end of the complex that were built in 2011-2012. (Coordinates: 39° 3'9.59"N 125°37'8.36"E) Neither is larger than 20 meters wide and there was no evidence of excavation work during their construction to suggest they cover an

underground entrance. Small hardened structures like these are common enough and are often used to store fuel or for other benign purposes.

There is also a small trench-like structure that is barely two meters wide that lies in the northeast section. (Coordinates: 39° 3'19.82"N 125°37'15.41"E) It does not connect to any building and doesn't match the design of any other underground entry point one can find throughout the country. If it is supposed to be part of a UGF, I would say construction is just in the initial stages.

Most underground facilities are easy to spot.



One such facility is between the cities of Pyongsong and Sunchon, beneath Mt. Sonje. It has four entry points and there are piles of debris that were excavated from inside the hill during construction.

In other cases, where a building hides the entry point, the building is flush with the hillside. None of the main buildings at Wollo-ri are flush with the hillside. The other buildings at Wollo-ri could only hide a UGF that was constructed directly beneath them and there is no evidence of that having occurred. (Construction wasn't caught on imagery and no large debris piles are evident.)

In the event where you connect a UGF to a building that isn't flush with the surrounding landscape, a connecting structure is built. A prime example of that is a connecting tunnel that was built in 2017 and connects a building in the Armed Forces District of Pyongyang to a massive underground complex. It is approx. 6 meters wide and extends a maximum of 20 meters to reach the hill. Prior to this connecting structure, the main entrance, 660 meters away from the newer one, was still identifiable.

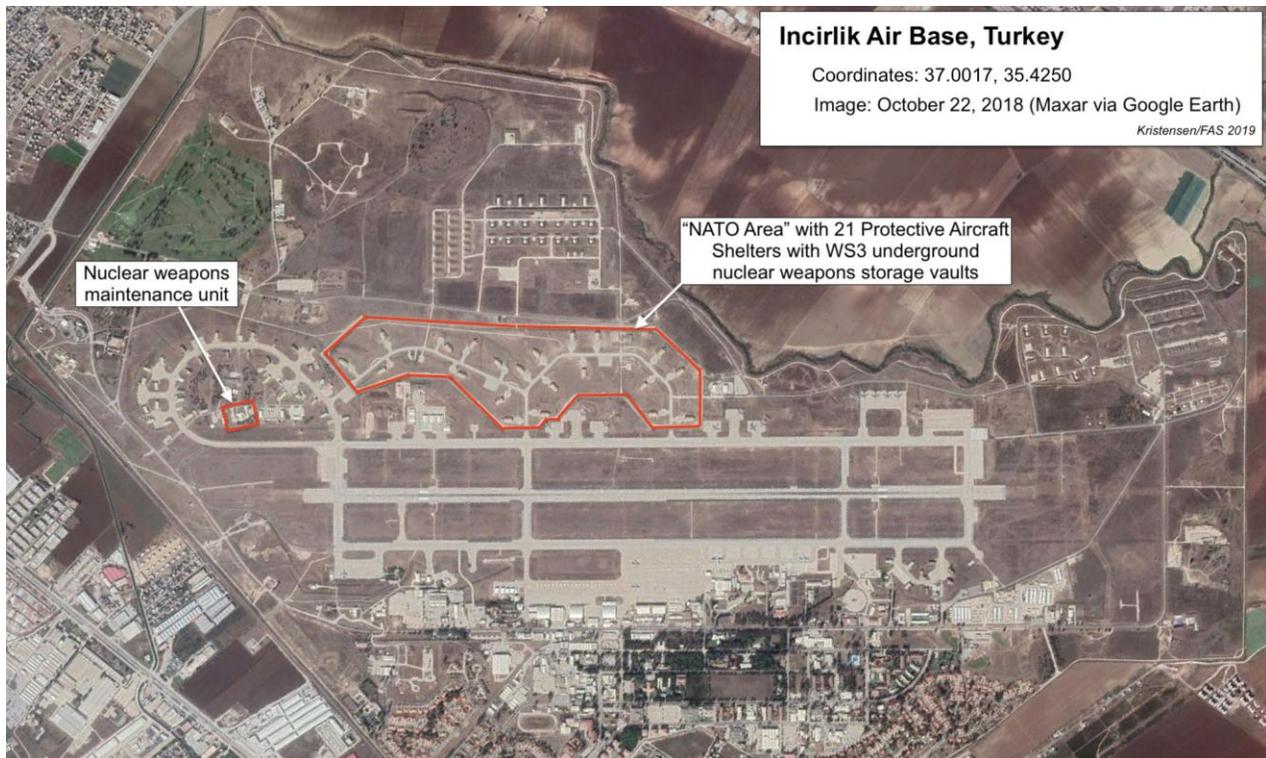


Warhead storage possibility

Lewis' addition of the [description](#) of an unidentified nuclear warhead storage facility is interesting but there was nothing in the description that mentioned Wollo-ri or that gave a specific location. The officials simply said there's a warhead storage site *somewhere*. In terms of storage, there are other more suitable places suspected of being warhead storage facilities, including one near the city of Kusong.

And when looking at known warhead storage sites around the world, a few trends become clear. Namely, very tight security and underground storage. The largest warhead repository in the world is the Kirtland Underground Munitions and Maintenance Storage Complex in the scrublands around Albuquerque. The underground portion alone covers roughly 57,000 square meters (not including the potential for multiple levels).

It has a single entry point, it is surrounded by fencing, and has three watchtowers. Plus, it is situated in the middle of a larger military complex.



Incirlick AB with US/NATO nuclear storage site highlighted. | Image source: [Federation of American Scientists/Hans Kristensen](#)

Turkey's [Incirlik Air Base](#) is another place that houses American/NATO warheads (up to 50). They are stored underground in the center of the air base which is the most secure area.

The lack of any identifiable underground facilities at Wollo-ri, its questionable security, and the lack of any direct mention of the site specifically as a storage facility leads me to conclude that while it may have a role to play in North Korea's nuclear program, the probability of it being a warhead storage facility is almost zero. Adding to that assessment are the additional facts that Wollo-ri is located far away from any long-range missile bases and the fact that it is located just a few miles of an elite section of Pyongyang.

In order for North Korea's ballistic missiles to be a credible threat, they must be near the warheads. Wollo-ri is nearly 70 km away from the nearest known ballistic missile base and that journey would take hours across miles of winding road and rail – an easy target to destroy.

And while North Korea does have a habit of meshing military and civilian areas together, any direct hit to a nuclear storage site would spread radioactive material across a wide area thanks to fire and wind currents, contaminating the city with highly enriched uranium and/or plutonium (depending on the type of weapons stored there).

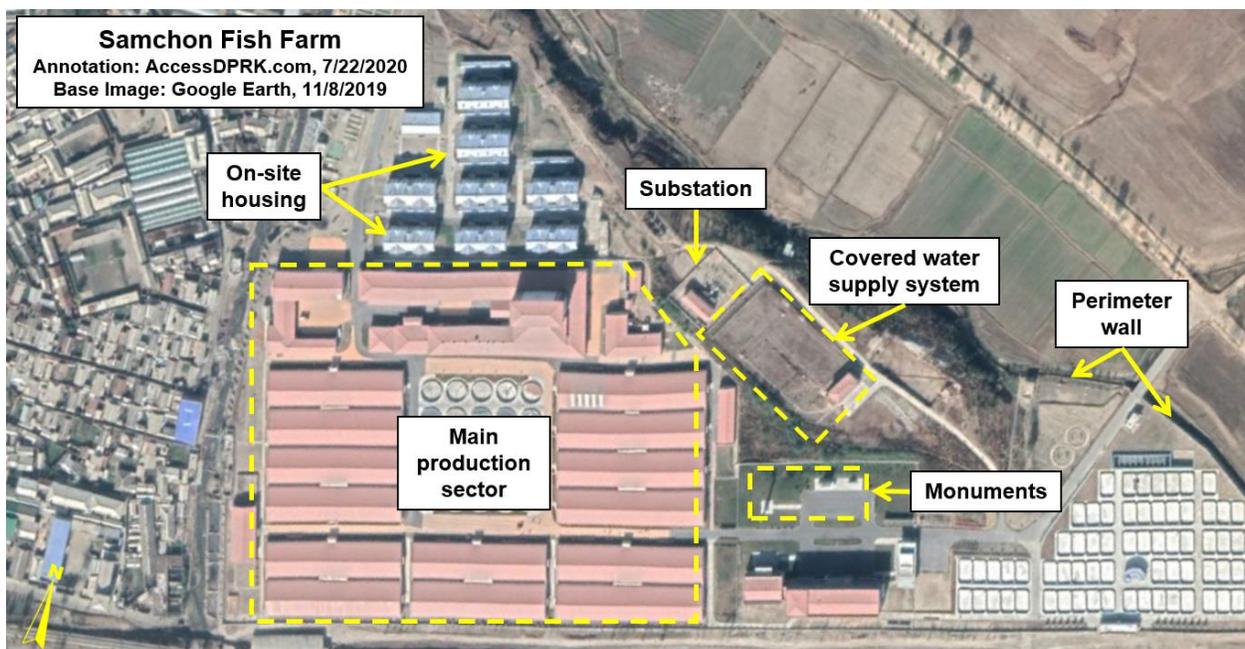
Political University?

I'd like to briefly discuss an alternative explanation put forth by an alleged North Korean official. He [claimed](#) that the facility is actually the "Pyongyang Anti-aircraft Unit Command's Political Military University". I and many others deeply question this explanation. There is a state security academy nearby at 39° 2'39.39"N 125°38'1.49"E, and it and all of the other known political and security schools follow a very specific pattern. Wollo-ri does not comport with that pattern and deviates from it in a number of ways. While I am not convinced that Wollo-ri is a nuclear-related facility, I reject the assertion that it is a mere political university.

Conclusions

While there aren't any other "unusual" facilities around Wollo-ri that could instead be the nuclear facility, the evidence provided for the site in question, in my estimation, doesn't rise to a likely probability – particularly when it comes to the question of it being a warhead storage site. The specific parts of Wollo-ri described are common to many other facilities (military, industrial, and educational), and it seems the claim rests largely on the book mention, for which other questions need to be answered before having the confidence to connect the intelligence assessment with this specific location.

Even when looking at all of the signatures discussed on the Arms Control Wonk post in combination, the perimeter, housing, monuments, etc. they don't add up to a unique identifier. To demonstrate this, one need only look at the Samchon Fish Farm (which underwent an expansion in 2019). It, too, has a security wall, on-site housing, multiple monuments, and it also has its own electrical substation and a water supply system that is partially underground.



But back to Wollo-ri. As a village it is unassuming, so the Wollo-ri facility certainly sticks out among the structures surrounding it. It just doesn't stick out in any specific manner. There are also less conspicuous (aka not unusual looking) military facilities in the area, some that include underground sites, that could theoretically serve as a production site. (The underground facilities at the Panghyon Aircraft Plant are [thought](#) to have played an early role in the country's enrichment program.)

Last note

On a personal note, I have never openly debated the analytical work of anyone before, so I want to take a moment to address this. Lewis and the other experts who took part in analyzing Wollo-ri are brilliant. That's rather self-evident when you look at each of their careers. I am not saying they are wrong, rather, I disagree with the conclusions drawn based on the evidence presented.

Wollo-ri is a "puzzle" in certain ways, as David LaBoon told me, and I agree with that. The fact the village has been mentioned in connection with the country's nuclear program by an intelligence official is intriguing, but the facility's aspects are vague, yet also show importance. Importance to *what* is the question.

As interest in North Korea grows and the tools available for open-source intelligence improves, the body of work relating to the country has exploded (pardon the pun). Having an open dialogue about differing analysis creates a fuller and more nuanced picture and serves to better inform the public and policy makers going forward.

Footnotes

A.

1. Shin Jong-woo of the Korea Defense and Security Forum [said](#), "*It may be a facility for another military purpose, not for nuclear warhead development.*"

2. Olli Heinonen, former deputy director general of the International Atomic Energy Agency (IAEA) [told Voice of America](#) that there is little possibility that there is a nuclear facility around Wollo-ri and that, "*the report does not provide clear evidence that the facility is nuclear-related.*"

3. A [report](#) by the Korean Broadcasting Service also noted, "*South Korea's military and intelligence authorities have dismissed a CNN report that said activity suspected of being nuclear warhead production.*"

B. There are five apartment buildings in a cluster and a likely sixth (that's of a different layout) near the southern end of the facility. Each building is seven stories tall. Estimating the first five buildings have 10 apartment suites on each floor, that comes to 350 units. And the sixth building has eight suites or 56 units for the building. That totals 406 apartment units. Depending on the actual layout of the units, there could be fewer or substantially more.

I would like to thank my current [Patreon](#) supporters: Amanda O., Andres O. GreatPoppo, Kbechs87, Planefag, Russ Johnson, and Travis Murdock.

--Jacob Bogle, 7/23/2020

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