THE ART OF PHOTOGRAPHY
USING MAGNESIUM RIBBON.

By Garry K. Smith ©

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Have you ever heard of the terms "flash powder", "magnesium flare", "magnesium lamp", *Blitzlichtpulver* or *Vacublitz* bulb? These are just a few of the illumination methods and devices used by early photographers. This old technology can still be viable today if you are after a particular photographic effect.

Photographers extensively used magnesium powder mixed with other highly inflammable chemicals, during the early part of the century and even as late as the 1970's magnesium in the form of ribbon was still used by some diehard cave photographers. Today many people regarded it as more of a novelty than a serious illumination source and as a consequence little has been written on this subject in recent times.

The technique involves setting up a camera on a tripod and using time exposure photography. The use of pure magnesium ribbon flares are best suited to large chamber shots where a lot of light is required to illuminate the chamber and expose the film. This form of lighting had its place in earlier times and has largely been superseded by large electronic flash units which are less hazardous and easy to use. Readers should take special note of the hazards, ethics and by-product sections of this article. However there are some occasions where a photo with a difference will catch everyone's eye and this old technique could be the opportunity for you to take that shot.

For those people interested in having a go at this form of photography, you will first need to source a supplier of the magnesium ribbon. A good place to begin with is your local pharmacy. They will most likely refer you to a chemical or laboratory wholesaler. When you have purchased the ribbon, only remove about 300 mm from the roll and place it in another air and moisture tight container. This will reduce premature oxidation which will reduce the effectiveness of the ribbon. The ribbon coil is usually purchased in a strip 3 mm wide x 0.25 mm thick and up to 2 metres long.

By-products of combustion.

Magnesium powder or a thin ribbon of the metal is easily ignited and burns with a blinding white flame. The burning process produces a mixture of the oxide MgO and Nitride Mg_3N_2. These by-products make up the resultant white powdery ash and the white smoke which rises from the burning metal.

Hazards associated with burning Magnesium

Avoid looking directly at the bright light emitted from the flame as this can cause eye damage similar to a welding flash. Avoid breathing the fumes and be aware of the small piece which will drop to the ground still burning. Heat from the burning metal can inflict nasty burns if in contact with the skin.

Because of the quantity of smoke produced during the burning process, photographers should only use magnesium as a lighting source in large well ventilated caverns.

Ethics

One must be mindful of the ethics of burning magnesium in a cave. It may be argued that the burning of magnesium is introducing a foreign material into the cave. This may be true, however if one is extremely careful to collect all of the oxide powder, the issue will centre on the white smoke produced and its effect on the cave ecology. The best advice is to consider each cave and

it's ecology on an individual basis before embarking on a photo session using magnesium ribbon. For instance the burning of magnesium and the fumes produced would cause excessive disturbance to bats, particularly when they are hibernating. Therefore, photographers should take special care to avoid roost and hibernation caves when undertaking this type of photography. The question of reduced oxygen from burning magnesium, should not enter the argument as we humans will deplete the oxygen level merely by breathing.

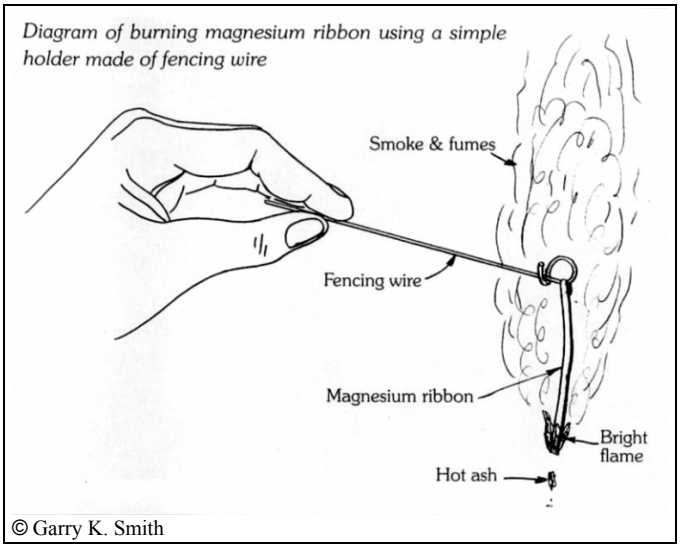
Magnesium is a fairly abundant metallic element, although it does not occur naturally in its pure form. It constitutes about 0.13% of sea water and is a major component of dolomite $CaMg(CO_3)_2$, a carbonate rock in which caves may be found.

Magnesium plays a vital role in the life process of plants and animals. It is present in chlorophyll, the green coloured substance which enables plants to produce carbohydrates as part of the photosynthesis process.

Magnesium also takes part in the duplication of substances called DNA and RNA, which have a key role in determining the heredity of all organisms. Magnesium also activates many of the enzymes that speed up chemical reactions that occur in the human body.

Experimenting with Magnesium ribbon.

If you are not familiar with how this metal burns, it is probably worth having a test run outside the cave - away from other flammable materials.



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You will need a short piece of fencing wire about 100 mm long, with a small loop bent into the end. Then bend the very end of a 100mm length of magnesium ribbon through the fencing wire loop so that the ribbon will hang vertically from the horizontal wire. Note, that in the cave you can vary the length of the ribbon to suit the size of chamber to be illuminated. Light the end of the ribbon furthest from the attachment point on the fencing wire. This can be tricky with a match as the end or the ribbon will need to be held in the flame for some time before the magnesium begins to burn. A better alternative is to use a cigarette lighter. Once alight, look away from the bright flame and admire the scenery. Avoid breathing in the fumes. The flame will burn up the strip at about 10mm per second, but this can


Self portrait of the author – Main Cave Timor N.S.W Australia, lit by magnesium ribbon.

Steven Marriott in Wolfs Cavern – Colong Cave NSW Australia, 200asa Kodachrome, 3 sec exposure © Garry K. Smith

vary slightly with the state of the ribbon. Bear in mind that when the ribbon burns up to the attachment point on the fence wire, a small piece will drop to the ground still burning. Therefore it is imperative that the burning strip is held at least 300 mm from your body and in a position so that the hot stub will not fall onto your boot or any other flammable item. The small amount of remaining white ash should be collected from the cave floor and disposed of thoughtfully.

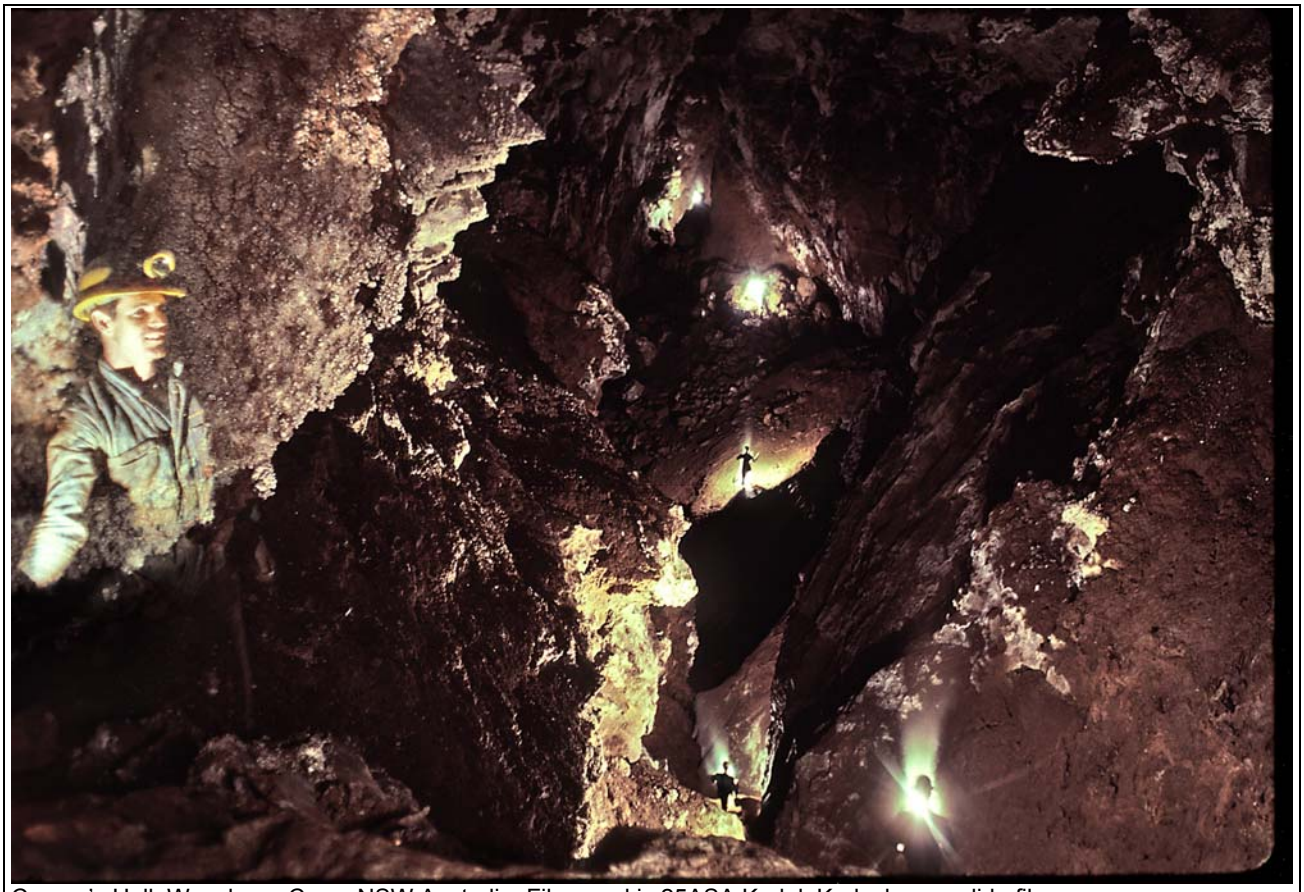
This sounds simpler than it really is, especially when the willing participants for your photo must do most of this in the dark and keep almost motionless.

Setting up the Exposure.

1. The person or persons to be subjects in your creation need to be familiar with how to light the magnesium ribbon and the dangers. i.e. heat, fumes and bright light produced from the magnesium flame.
2. Have your camera set up on a tripod with a shutter cable release fitted. Have at the ready a matt black card if taking multiple flare photographs.
3. Plan the sequence and procedure for the exposure with each of the participants involved. Demonstrate what you (the person operating the camera) will be doing, especially if a number of flares are involved. *See details of* ***Procedure for multiple flares in large chambers.***
4. Position the willing participants in appropriate positions in the cave chamber and within the camera field of view so as to produce maximum effect.
5. Each person should not move during the exposure.
6. Place a small torch on the ground behind the camera, facing away from the camera field of view. Leave it switched on during the exposure to aid in locating the shutter cable and avoid tripping over the setup.

Procedure for multiple flares in large chambers.

Set up the camera equipment and everyone in position. Get the furthest person from the camera to light their flare. Soon as it lights that person resumes a pose so that the flare is hidden behind their body but will light the chamber and create a silhouette of them. Open the camera shutter as soon as the person resumes their pose position. When the flame extinguishes, the person behind the camera places the black paper in front of the lens. The second most distant person from the camera then lights their flare and immediately resumes a pose position. The black paper is removed from in front of the lens. This process is repeated until each person has lit their flare. Bear in mind that if people are spaced sufficiently apart, then the first person to light the flare can avoid an agonising wait by sitting down and relaxing after the next person closer to the camera has finished with their flare. In other words when the flare from other people will not have an effect in lighting up a person or the cave wall behind then, they may resume a comfortable position in the dark.



Caesar's Hall, Wyanbene Cave, NSW Australia, Film used is 25ASA Kodak Kodachrome slide film, Exposure 10 minutes at f2.8. © Garry K Smith.

When all flares have been lit, the person behind the camera can close the shutter with the cable release. All this sound easy but the photographer will need to spend some time discussing the procedure with the willing participants.

Bear in mind that this system can be used with just one or two people in the same photo several times. It is really up to your imagination and the chamber you are trying to illuminate.

Because the burning of magnesium ribbon can be a variable light source, it can be a bit of a hit and miss affair with your results. In Australia, the ribbon which I purchased many years ago was used with great success in a number of large chamber shots. The best results were gained using Kodak 25 ASA or 64 ASA slide film and opening the aperture to about f3.5, then using about 100 mm of strip. The aperture setting and strip length can be varied to suit the chamber size and film speed.

While setup in a cave it is little extra effort to take several extra shots in the one place using new pieces of ribbon the same length, but varying the lens aperture. Keep note of your aperture settings. After one roll of film is developed it will be obvious which is the best exposure and a pattern quickly develops in relationship to size of chamber and your lighting requirements for a particular type of film.

This photo involved five people, including myself operating the camera. The two people holding flares, nearest the camera on the right are actually the same person. The three people scattered down the chamber also lit flares. However, because of the distance involved the furthest most is obliterated by the bright light.

Several electronic flashes were set off behind the camera to illuminate the roof of the chamber (100m at its highest point.) However this made little impact on overall illumination.

I walked into the left side of the picture and set off an electronic flash at arms length - in hind sight a mistake which detracts from the photo. The cave wall was lit by earlier electronic flashes before I moved into the picture.

The results can be as astonishing and varied as your imagination. If you are after something different in a photo give it a go.

MAGNESIUM AND THE BEGINNING OF FLASH PHOTOGRAPHY.

If we briefly look back at history, magnesium was first discovered by the English chemist Sir Humphry Davy in 1808, but it remained a very expensive scientific curiosity until the early 1860's when Edward Sonstadt of Manchester developed a method of refining the metal.

Wolfs cavern – Colong Caves NSW Australia, Greg Powell holding the magnesium ribbon. Note the effect of just seeing the flame and the rising smoke. Slide film, Kodachrome 64ASA © Garry K. Smith

In 1864 Alfred Brothers a photographer from Manchester was the first to use magnesium light to take portrait shots. For exposures only requiring 15 to 30 seconds of illumination, an appropriate length of magnesium ribbon or wire was pined to a stick and lit. Also during 1864, a magnesium lamp first appeared. It burnt long strips of ribbon, fed into the lamps by a clockwork motor. This advancement enabled photographers to illuminated larger areas.

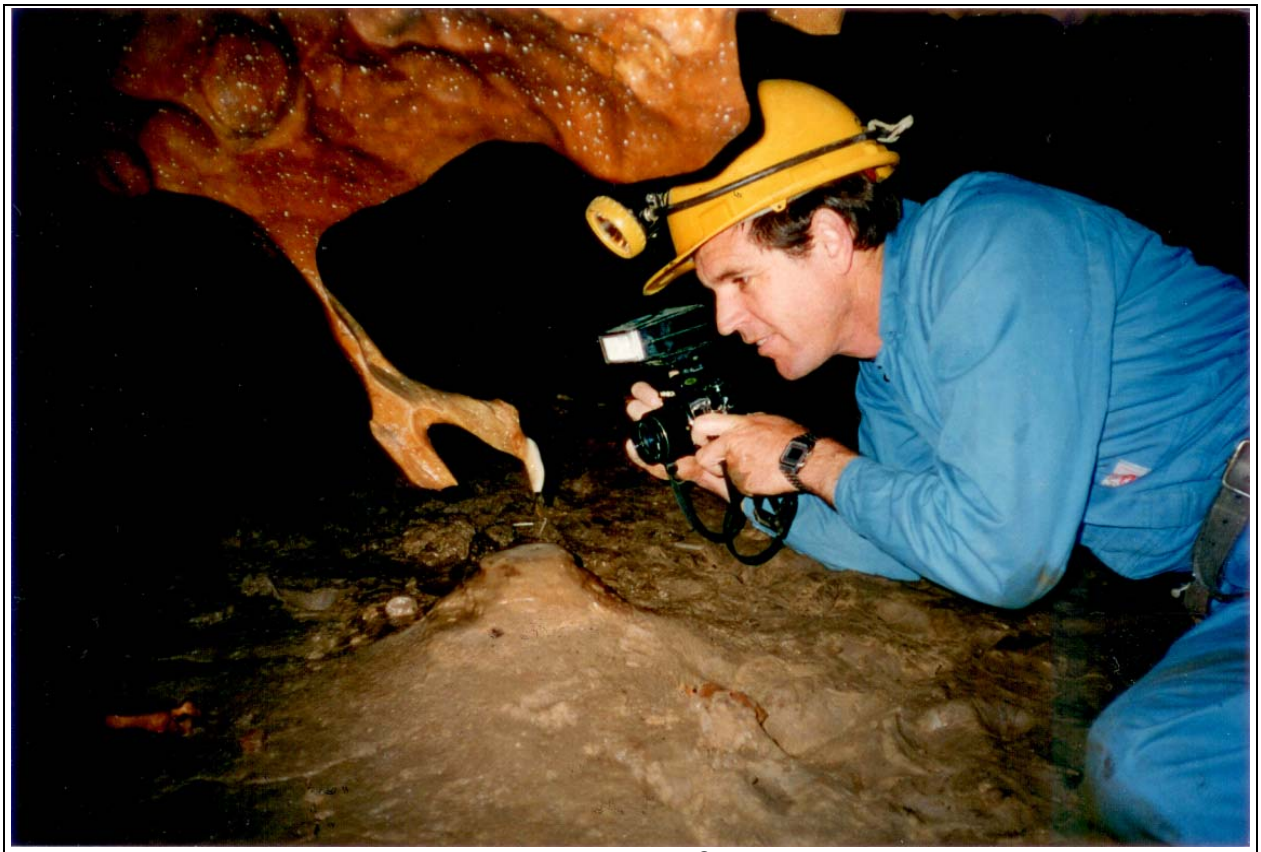
Then in 1865 Charles Pizzi Smyth, used magnesium ribbon to photograph inside the Great Pyramid of Cheops. Others followed, including T.H.O'Sullivan, who in 1867 took photographs hundreds of feet underground in the Comstock Lode mines of Virginia City, Nevada. To illuminate the subjects he used a magnesium flare - a dangerous and almost suicidal act in mines where flammable gas might be found.

Magnesium prices dropped during the 1880's. More sophisticated magnesium wire lamps continued to be developed. They were operated by a spring mechanism which advanced the burning wire through a small tube mounted in the middle of a dish reflector. Variations on these lamps could be still purchased up until the late 1920's. However, it was the improvement in photographic material sensitivity which led to the development of short duration flash photography. These included a host of magnesium powder burners which appeared on the market during the 1880's. A puffer was used to blow magnesium powder through a hot flame, usually that of a spirit lamp.

Adolf Miethe and Johannes Gaedicke in 1887 invented the *Blitzlichtpulver* which used a highly explosive mixture of magnesium powder, potassium chlorate and antimony sulphate as a form of photographic illumination. It was an improvement over the magnesium flare as it burnt instantaneously giving off a flash of light. Unfortunately the flash powder photographer had little control over the quality of light, but it was a way of creating enough illumination to take a snapshot. Other variations of this flash powder technology and ignition systems soon appeared on the market.

The Swedish engineer Magnus Niéll in 1899 patented a camera with a built-in flash tray and synchronizer. As the shutter fired a pin was released to strike a percussion cap in the flash tray, full of powder. However it appears that the device never reached commercial application.

The next major breakthrough came in 1925 when Dr. Paul Vierkötter patented the flash bulb. It consisted of a magnesium powder covered filament inside an evacuated glass globe. When an electric current was passed through the filament the powder ignited, giving off a brilliant light for a fraction of a second. Refinements on the flash bulb led Johannes Ostermeier in 1929 to introduce the *Vacublitz* bulb in Germany; it was based on Vierkötter's suggested aluminium foil design of 1927. This heralded the end of portraits taken with chemical explosions and clouds of smoke. However, photographers still used the "open-flash technique" - open the shutter, fire the flash by hand, close the shutter. It wasn't until 1932 that the first flash synchronised cameras began to appear on the market. The advancements from this point on continued in leaps and bounds. Despite this magnesium ribbon continued to be used as an illumination method among some cave photographers.



Garry Smith photographing the Claw. Codrington, Victoria, Australia. © Garry K. Smith (photo taken by his son Michael aged 12 at the time). *Colour print. Kodak Gold III, 200asa. Canon prima AF-7 camera.*