

**SAFE**

**GEOLOGIST**

# **Safety in Fieldwork:**

**Amateurs, Students, Teachers AND  
Professionals**

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(until 31<sup>st</sup> January, 2012: Professor of Geotechnical  
Engineering at Kingston University)

Particularly risky where the sea slopes appreciably towards the land!

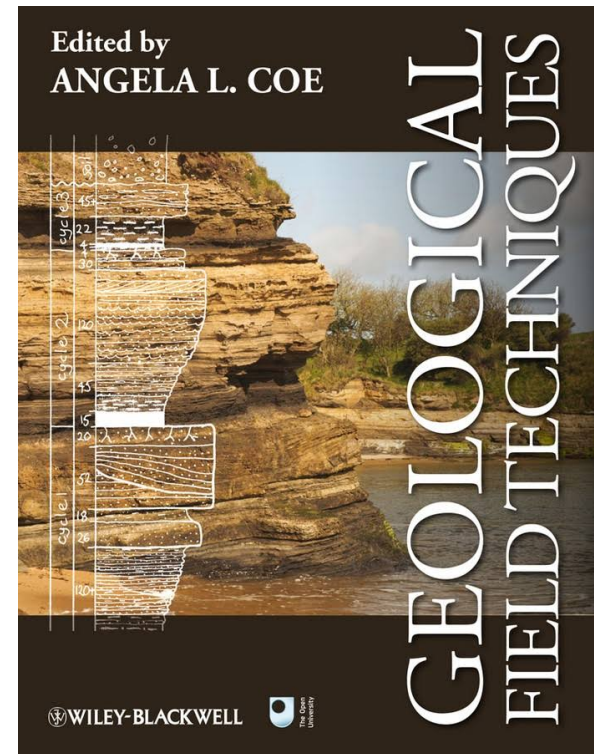


Heads up to:

# Dr Ian West (ex Southampton Uni)

Dr West maintains a large number of excellent pages on his site, including first-rate advice on geological fieldwork safety in the UK, noting special factors relating to working on coastal exposures.

Angela Coe's book contains much useful information, but is often weak on the safety angle. (e.g. working on active construction sites)



# There are many issues common, but some different, between:

- Taking a school party of students out on guided field courses
- Taking a party of (adult) students out on guided field courses
- Taking members of a professional body out on a field excursion
- Small parties on research projects
- Small parties conducting professional work
- Working on your own



As leader or participant

# How it was ...



1978

# Hazards

- To YOU from OTHER PEOPLE
- To YOU from ANIMALS, INSECTS, PLANTS
- To YOU from the GEOLOGICAL ENVIRONMENT
- To YOU from the CLIMATE or WEATHER
- To YOU travelling to, from and on site
- ... And of course, *vice versa!*

*But also:*

- To YOU from YOURSELF

**Lack of preparation may turn a hazard into an accident – or a disaster: part of the preparation is to do a risk assessment.**



# Risk Assessment

- What are the hazards?
- What must be done to ameliorate them?
- How will the rules be enforced?
- How will unforeseen problems be addressed?
- Who prepares the Risk Assessment?
- How is it disseminated?
- *Do not bring this process into disrepute by being silly about everyday things*

Plan your route

Who knows where you are?

*(and what are the criteria for deciding that you are missing?)*

Keep in contact

Personal conduct



# Hazards to you from other people



- Pirates
- Kidnappers
- Muggers and thieves
- Rapists
- Naturists
- Naturalists
- Demonstrators
- Rioters
- Landowners
- Members of your own group!

“If you are held up by armed terrorists who want the LandCruiser – give it to them..”



# Hazards to you from other people



Often, drivers use excessive speed down narrow country roads. (Mock rally cross). You are at particular risk in countries where they drive on the other side of the road, (or foreigners working with you)\*.

These traffic risks include alighting from a car or bus or on a railway.

*\*India, Australia, New Zealand, UK & Ireland, Indonesia drive on left – a third of the world population, including the biggest democracies.*

# Stone chips – not just from hammering

How much is your eyesight worth?  
What is in your PPE?




Price: **£1.99** ex vat

**Java Budget Safety Glasses**

Product Code: i907

Discounts	price per item (ex vat)
1 - 5	£1.99
6 - 20	£1.89
21 - 50	£1.79
51 - 100	£1.69
101+	£1.59

Quantity:   **BUY NOW**

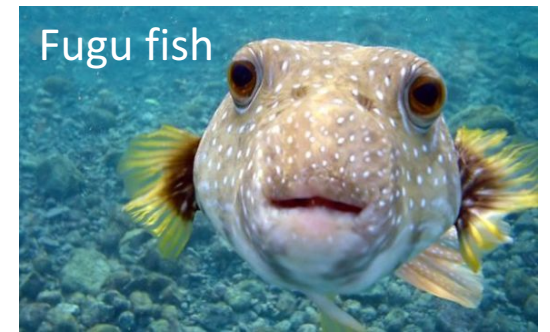
 [Full Specifications: Click here](#)

# Hazards to you from animals

- Dangerous wild animals (few in the UK!)



Steve Irwin, killed  
by  
a stingray sting





## Snakes, but especially bugs ...

“There are 18 species of mosquitoes at this location, all of which carry potentially life-threatening or debilitating diseases, including: malaria, haemorrhagic dengue fever ...” (Luang Prabang, Laos)



Photo: John Albers-Mead



ADAM



Monkshood



Deadly Nightshade

Poisonous plant and fungus species may be different in Italy and the UK, or in other countries. Some plants sting or are irritant, they may have poisonous needles. Some may be host to poisonous invertebrates.



Death Cap



Destroying  
Angel



# Hazards to you from things

The illustration was irresistible.

All rock faces shed blocks from time to time. The risk is least if they are engineered slopes in a first-world country, and most in freshly blasted faces in a quarry somewhere where the safety rules are ignored.





The hard hat is uncomfortable and awkward, and this is a great disincentive to wearing it. It only provides absolute protection against small impacts, but the relative protection against larger impacts is still valuable. It must be fitted securely, and used within its valid date range.

If it is windy, you need a chin strap

Many people feel shy of wearing a hard hat, especially in public places ...  
But:





Sometimes you are in someone's working environment.

Be prepared to be chased off, or lectured at – or be given a safety briefing. Conform to all regulations on any construction site, quarry or mine.



Wonderful!

What is the fence for?

# Hazards to you from machinery



Reversing, slewing, tensioned cables, high voltage electrics, dropped or dislodged rocks ...

Badly-loaded trucks, too rapid manoeuvres, soft ground ...

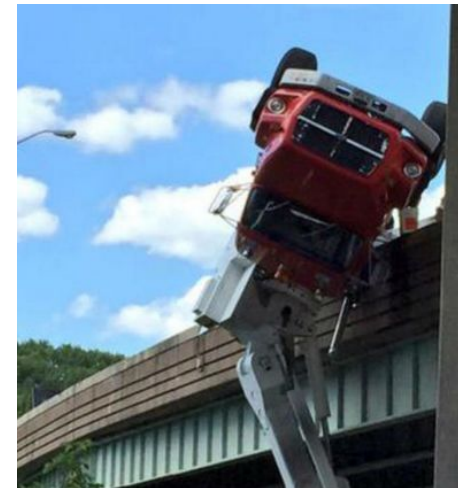


poor visibility from cab ...

Cranes & aerial work platforms have inherently poor stability.



Not that this normally affects Geologists, but boats and barges may become unstable when heavy items are lifted off the deck.



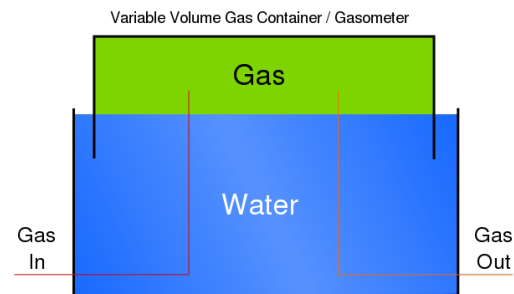
# Chemical hazards

Left: Seattle gas works – only surviving example in the USA.

In the UK, there were 1800 gas works, making gas from coal. This has been superseded by natural gas. All UK sites now demolished. Sites tend to be polluted with tar, phenols, cyanide, L/DNAPLs (Light/Dense non aqueous phase liquids)

*All illustrations: Wikipedia*

Below: gasometers for storage of gas. The underground part is full of water and is usually also contaminated by dissolved compounds.



# Biological hazards

- Brownfield sites, discarded needles, medical wastes
- Broken glass
- Asbestos
- Human and animal wastes
- Condoms

No picture!





# Explosions

Unlike in the immediate postwar period, it is now unusual to find mines on beaches. However, there are still lots out there.

Unexploded mines, bombs and shells, including those containing poison gas, are out there. These include deliberately emplaced explosives, discarded ordnance, practice rounds on ranges, etc.

The situation is worse in other countries.

**ADVICE:** If you don't know what it is, don't touch it. Better still stay away. Certainly don't tap it with a geological hammer!

Some quarries where explosives are used are crossed by public footpaths. Obey warnings.

# Unexploded Ordnance (UXO)

This is a 1000 kg bomb dropped on London in 1944.

It was still live when discovered in June 2008

The fuze contained anti-tamper devices to foil bomb-disposal, and actually started ticking while a bomb-disposal expert was working on it. The timer was disabled with injection of salt water and a strong magnet.

The tonne of explosive was extracted by dissolution/melting in hot water (“steaming”).

It was uncovered when dredging the river Lea at Bromley by Bow.

German devices can often be identified by serial and/or type numbers.

UXO discoveries are far more frequent in Germany due to the greater tonnage of bombs dropped there.



# Unexploded Ordnance

Some of the bombs were designed not to detonate immediately, but were booby-trapped to kill bomb-disposal crews. They could catch YOU.



The Germans also employed primitive cruise missiles (V1) and supersonic ballistic missiles (V2). Both carried a payload of approximately 1000kg of high explosive. Some fuel residues could still be potentially flammable/toxic/explosive. About 22,500 V1 missiles were launched, and over 3,000 V2 missiles, half of the latter at London but also against some European sites, notably Antwerp.



Aircraft returning from air raids often crashed. Aircraft shot down could distribute their own ammunition around the crash site.

Note that anti-aircraft fire if it did not detonate would return to the ground as a live UXO. Today, SAMs that don't find a target crash to the ground and may detonate or not.



# Unexploded Ordnance – Europe – WW2



The ABC Lancaster I *NG128* coded "B-SR" of 101 Sqn out of Ludford Magna, dropping its load over Duisburg on Oct 14/15, 1944.

**Left image:** the Lancaster releases its load of 4lb stick incendiaries - 1,170 of them.

**Right image:** several seconds later, the aircraft releases the main part of its load, a 4000lb HC "cookie" and 108 bigger incendiaries of the 30lb "J" type.      1 kg = 2.2 lb

There could be 1000 aircraft in a raid.

NB: 2.2 lb in 1 kg.



# Unexploded Ordnance – WW1



Above left: A “dud” shell, but still live. Above right: a live shell found recently, awaiting bomb disposal – over 90 years later.

A number of live munitions contain poison gases such as mustard gas. Locations in Western Front through Belgium, France, N. Italy; Eastern front between Germany and Russia. Possibly also Middle East.

# Unexploded Ordnance – Mines

Extensive bombardment and mining throughout N. Africa, Europe, Pacific countries, China, Korea

Korean War

Vietnam War

Iran-Iraq War

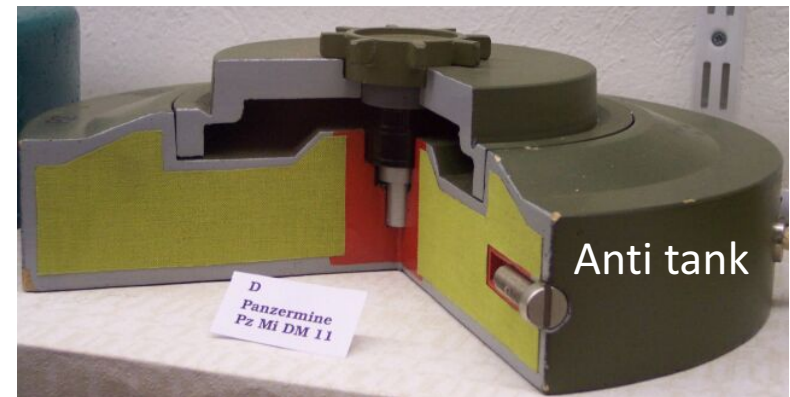
Falklands War

Arab-Israeli Wars

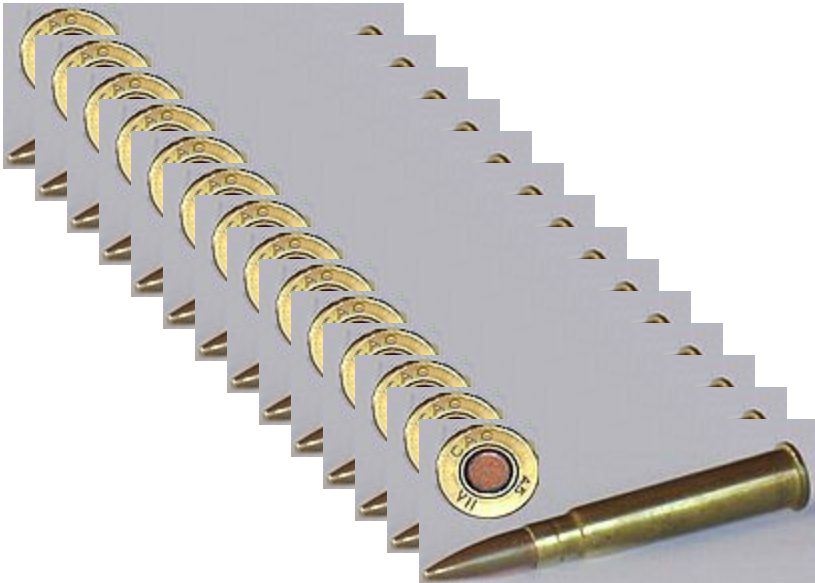
Chechnya, Georgia, former soviet republics

India-Pakistan War(s)

Mozambique, several other African countries



# Unexploded Ordnance – found by ENB



I have personally found – in the UK - 1 live Mills hand grenade (top left), a loaded Colt revolver (top middle), a live 2" mortar round (top right) and 200 rounds of live .303 ammunition (left) discarded in shallow sea water and corroded.

The late Professor Simons (Surrey Uni) collected ordnance from the WW1 battlefields as a hobby: it caused a major disposal problem!



- Do not forget radiological hazards: (over 2000 airburst nuclear weapons tests)
- Carcinogenic & radioactive minerals
- Poisonous minerals (see [listverse.com](http://listverse.com) for 10 most poisonous):

Cinnabar  
Orpiment  
Stibnite  
Torbernite  
Arsenopyrite  
Chrysotile and Amphibolite Asbestos  
Galena  
Hutchinsonite  
Chalcanthite  
Coloradoite

Various elements including  
Mercury, Lead, Thallium, Arsenic,  
Sulphur etc.

- Confined spaces:

Gases: Radon, CO<sub>2</sub>, CO, Methane

Caves, tunnels, shafts, pits

# A few physical hazards

- Trapped in soft mud, peat bog
- Debris slides and mudflows
- Rockfalls, avalanches
- Scree
- Cliff edge – remember the girls?
- Volcanic eruption, lava, ashfall, lahar
- Snow-covered cavities
- Caves (including gas hazards)
- *etc*

# Hazards to you from weather



A light snowfall on the A6 road in Cumbria – now where's that outcrop?



Getting soaked in a tropical downpour is normally not a problem.

In northern Britain, or in the winter, it can lead to chilling.

Some types of clothing are notorious for heat loss when wet, and with poor drying characteristics.

**“There’s no such thing as bad weather, only the wrong clothes.”**



Fieldwork is not a fashion competition

At the opposite end of the scale is sunburn. It can be suffered in the UK!

Cover up..... *(Note the traces of inappropriate garments worn by this geologist. I did tell her that you should wear more in Saudi Arabia!)*

Also use sunscreen. Having black skin is often no protection!

(NB, the early signs of black skin sunburn are not obvious to pale skinned Europeans with no knowledge or experience)

Snow reflects a lot of UV light, so you may get sunburn in unusual places, e.g. under your chin. The nose is vulnerable from sunglasses' reflections.



# Time and Tide!

High tides are predictable. In coastal locations high tides can reach the foot of the cliff, or cut off escape. May not be a familiar hazard to Mediterraneans.

*(Example: the Chinese cockle pickers in Morecambe Bay?)*



Floods are less predictable. Floods in streams can be the result of hydroelectric scheme operation, or spillways kicking-in. Syphonic spillways are particularly fast to run up to peak discharge.



# Lifting and Carrying

- Back injuries are the greatest single cause of absenteeism from the workplace, often caused by manual handling activities, *e.g.* the lifting and carrying of loads.
- Geological specimens (and some of the tools) are not light.





# Noise

Quarry blasting, machinery



How do we reconcile camouflage clothing with High Visibility?



# So, your personal protective equipment (clothing)

- Be seen
- Maintain an appropriate temperature (warm, cool)
- Eye protection
- Head protection, helmet
- Foot protection, blisters
- Skin protection
- Gloves

You need a first aid kit or kits appropriate to the size of group and number of locations the group is separated into



... and people trained and certified to give first aid



**Not quite the business:**

Boots with ankle support

Comfortable clothes with multiple layers

On top of the cliff, so not a hard hat zone

Even when not adjacent to road or railway, high visibility still a good idea.

I'll pretend they are safety glasses ...

Oh, but not jeans!

(Not so bad here, at most 200m from a cafe!)

# Slip and Trip

- You need appropriate footwear. By appropriate footwear, I mean proper boots, with good tread on the soles to avoid slip risk. Good stout walking boots keep your feet and ankles supported and your feet dry.
- A stick can be helpful in keeping your balance – I use a combination stick that doubles as a camera monopod (but is something else to carry).

Fieldwork is not a fashion competition!



This is what a proper walking boot looks like. If it doesn't have a good tread, and it doesn't support your ankle, then it is useless.

Steel toecaps are required if the hazard is from dropped heavy objects, steel soles if the ground contains sharps.

# Carrying your kit

- Rucksack is best, but slinging & unslinging is inconvenient
- Chest sacks (*do NOT use as internet search keywords*) are good for keeping equipment handy and ready for use.
- First aid,
- weatherproof,
- food,
- drink, etc



OK in backpack



**AIRFLO**

AIRFLO OUTLANDER RUCK SACK & CHEST PACK

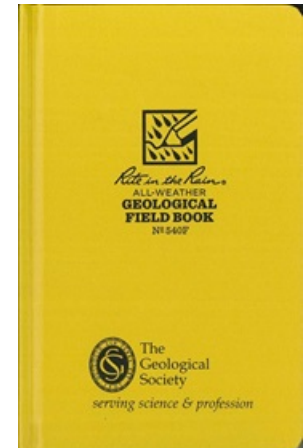


# Some field kit

- Compass/clinometer
- Hand lens
- Hammer – maybe
- Camera, camera-phone
- Notebook, pens
- Lights
- Tape measure
- Scale
- Binoculars
- Batteries, charger, powersource
- Sample bags / tubs
- Labels / knife / scissors
- Phone / GPS
- Money / **valuables**
- Secure pouches
- ID



**All of this needs to be carried**



# First aid kits



Eyewash is not always provided in First Aid kits



Refills for used or out of date items

Feminine needs items – especially if leading school parties

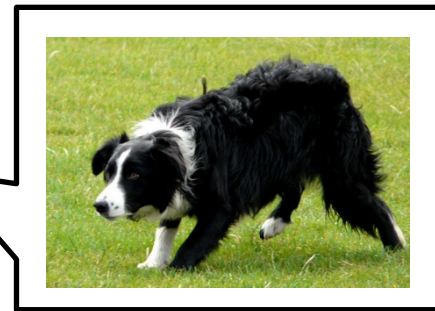


Prefilled first aid kits may not always suit the most likely health hazards – various party sizes require more content. Anti-venom in some places.

Analgesics – painkillers – may be subject to special rules for dispensing

# School excursions

- Some of you may find yourselves teaching in schools – my experience is through pre-University ‘widening participation’ activities with young teenagers
- Police records checks
- Male and female supervision staff requirements
- General demeanour and behaviour
- Special needs of particular students
- Food, drink and hygiene



# Transport: expedition vehicles and driving

- Fitness of the vehicle(s), vehicle legal requirements
- Fitness of the driver(s), qualifications and certification, insurance
- Daily checks: *oil, water, fuel, tyres*
- Stowage of equipment, luggage
- Security of equipment and possessions
- Also consider aircraft and boats in similar ways



Phones, smartphones, Youtube, social media, recording, filming, iPod, iPhone, phone call ...



# Advice: Be prepared

1. Wear (or take) appropriate clothing for the weather - expected and unexpected
2. Use high visibility clothing if appropriate
3. Wear appropriate footwear for the conditions
4. Take, and wear, a hard hat if working under any rockface or on site
5. Use eye protection, gloves
6. A stick can be helpful – I use a combination stick that doubles as a camera monopod

# Advice: Be prepared

1. Work in appropriate groups for safety
2. Post look-outs
3. Read and act on tide tables, weather forecasts, etc
4. Make sure someone knows where you are, and have “report-in” arrangements – important for lone working
5. Field party leader to give safety briefing at EVERY stop: for professional activities a safety briefing is needed AT LEAST each morning

# Advice: Be prepared

1. Take appropriate medication (even down to sunscreen) with you
2. Carry basic first aid kit – and have people in the group trained to use it. (Know who they are!)
3. Carry information on medical conditions for members of the party – what happens if someone collapses or is injured?
4. Good telecomms are always helpful

# Advice: Be prepared

1. In foreign countries, have an interpreter
2. Don't get lost – maps and GPS
3. Beware of traffic – both on public roads and if working on a site (construction *or* quarrying)
4. Avoid injurious minerals, plants, animals ...
5. Know what UXO looks like, and do not touch

# Some highly personal advice from me

- Don't bring supernumeraries on an excursion
- Avoid 'romantic' encounters
- Beware of entrapment
- Do not use or transport illicit drugs or other contraband
- Be aware of racial and cultural issues
- If any participant has regular medication, be aware what it is called in the country where you are working in case you need resupply



My favourite crossword clue:  
Workforce may speak – advice a  
geologist cannot follow (4,4,4,5)