A short history of photography

- The first successful picture was produced in 1827 by Niépce, with material that hardened on exposure to light. The picture required an exposure of eight hours.
- Various chemical systems followed, using the light sensitive chemical properties of silver solutions on glass, metal, gelatine and paper surfaces to ‘fix’ the images
- Thus began conventional or ‘film’ photography

A short history of photography

- Early 1990s the first digital cameras appeared on the market. By 2000 they started to rival film cameras and are now the norm
- Future developments in digital photography can only mean:
  - Convergence (mobile phones, video, computers)
  - Cheaper cameras
  - Higher resolution images
  - Larger storage capacities
  - Ease of use (everyones an expert!)
  - More features (some not even thought of!)

Digital vs Film

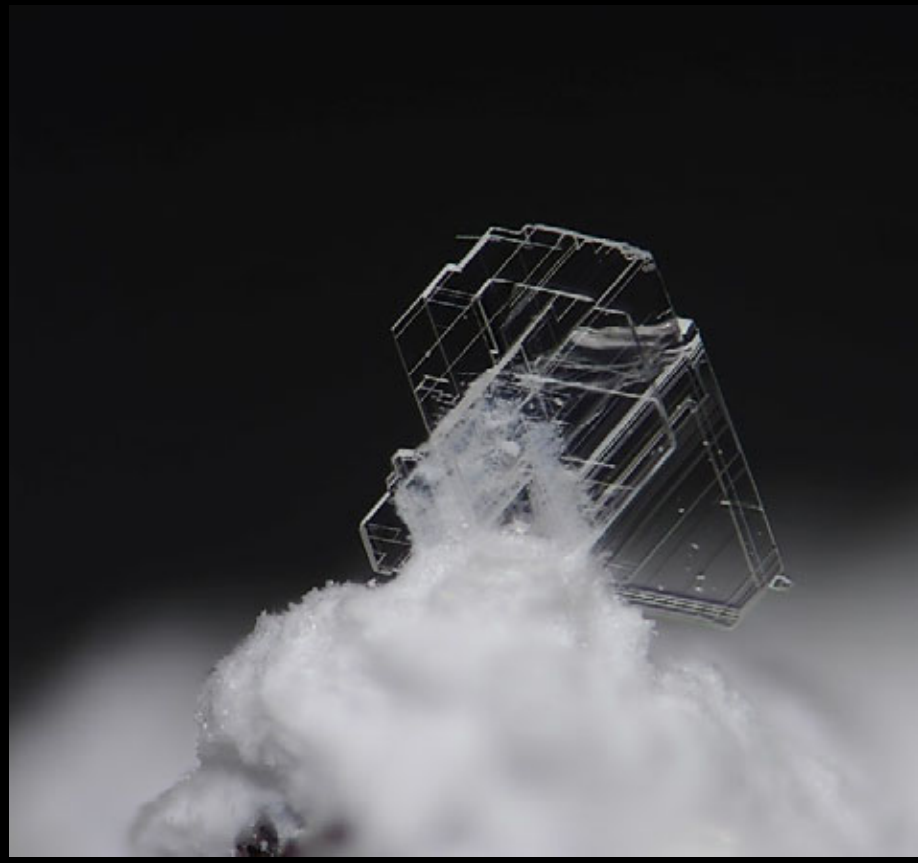
- Although film and digital photography utilise different technologies the fundamental physics remain the same
- The basis of all photography is the capture of the play of light upon a subject and its subsequent reproduction
- This, combined with a photographer's eye for composition, will ultimately be of more importance than the technology used

The fundamentals of photography

- An understanding of the following basics are required if you want to take consistently good photographs :
  - The camera **shutter speed** *(amount of time that it takes to capture an image)*
  - The camera **aperture** – *(the size of the hole through which light is collected to form an image)*
  - The film or CCD **sensitivity** *(ISO/ASA)*
  - The picture **composition** *(aesthetics of an image)*
  - Post camera **image editing/manipulation** *(in the past was a darkroom process, and now software manipulation)*

The fundamentals of photography

- You may not notice if these settings are even on your particular camera, but they will be lurking beneath the surface in one form or another
- So: this introduction is about giving you the knowledge to:
  - Find out what those settings mean
  - put more thought into your own technique
  - Taking great pictures!

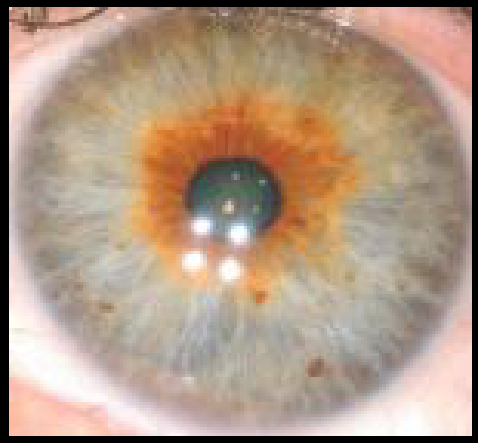


Those terms in more detail

- The functions of **exposure**, **aperture** and **ISO** are directly related to one another, and adjusting one of them will have a direct effect on the others
- So, a correct exposure is a balancing act between:
  - The length of time that light falls upon the film (or CCD) and . . .
  - The intensity if the light falling on the film or CCD
- Exposure can varied by:
  - changing the **length of time** for which light falls on the CCD *(shutter speed)* e.g. 1/60th sec
  - It can also be varied by changing the **aperture** through which light travels to reach the CCD

Those terms in more detail

- The **aperture** is the ‘hole’ through which light travels to reach the CCD
- It acts like the iris in your eye, opening and closing to vary the intensity of light falling on the CCD
- It is commonly referred to as ‘**f stops**’ e.g. f2, f16
  - f2 is a large hole, letting in lots of light
  - f16 is a pinhole letting in a small amount



Those terms in more detail

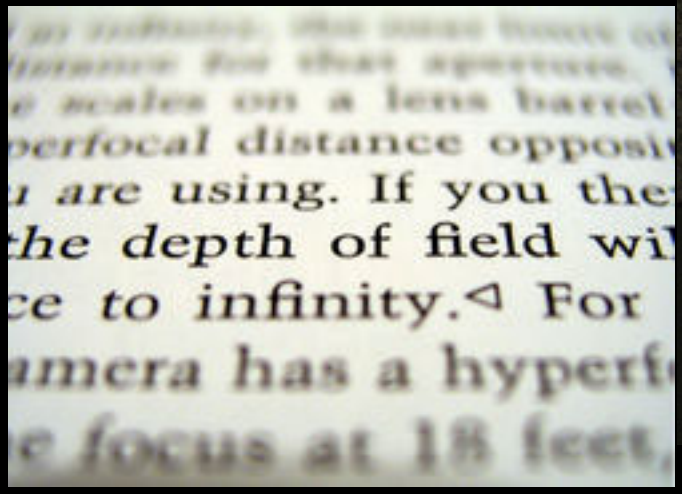
- **ISO or ASA** used to measure the light sensitivity of film *(e.g. 64 ISO or 400 ISO).*
- Digital cameras have continued to use this function, however it now relates to changing the sensitivity to light of the CCD via internal software
  - 64 ISO has low sensitivity to light
  - 800 ISO is very sensitive to light
  - *(e.g. at 800 ISO a much smaller amount of light is required to correctly expose an image than at 64 ISO)*

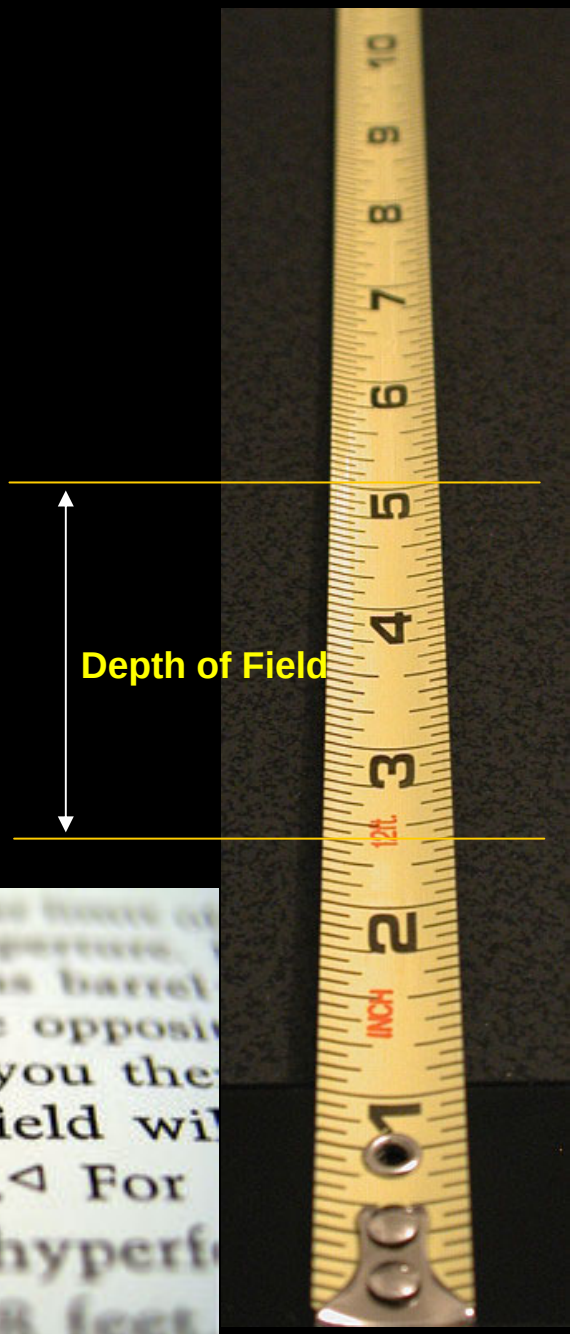
So what does this all mean??

- Imagine that light is actually water, and that a correctly exposed photograph is like a full bucket of water
- You can fill the bucket in two ways:
  - Use a tap with a very large nozzle over a short period, or
  - Fill it drip-by-drip, over a longer period. Both ways will result in the same overall amount being collected *(gathering enough light to correctly expose an image)*
    - e.g. a large aperture (f2) will require a very short exposure time to light, or else -
    - a small aperture (f16) will require a much longer exposure time, but both will eventually obtain sufficient light to expose the image to the same degree
- *However*, varying the aperture vs exposure time does have *other effects* on your photographs

Varying aperture

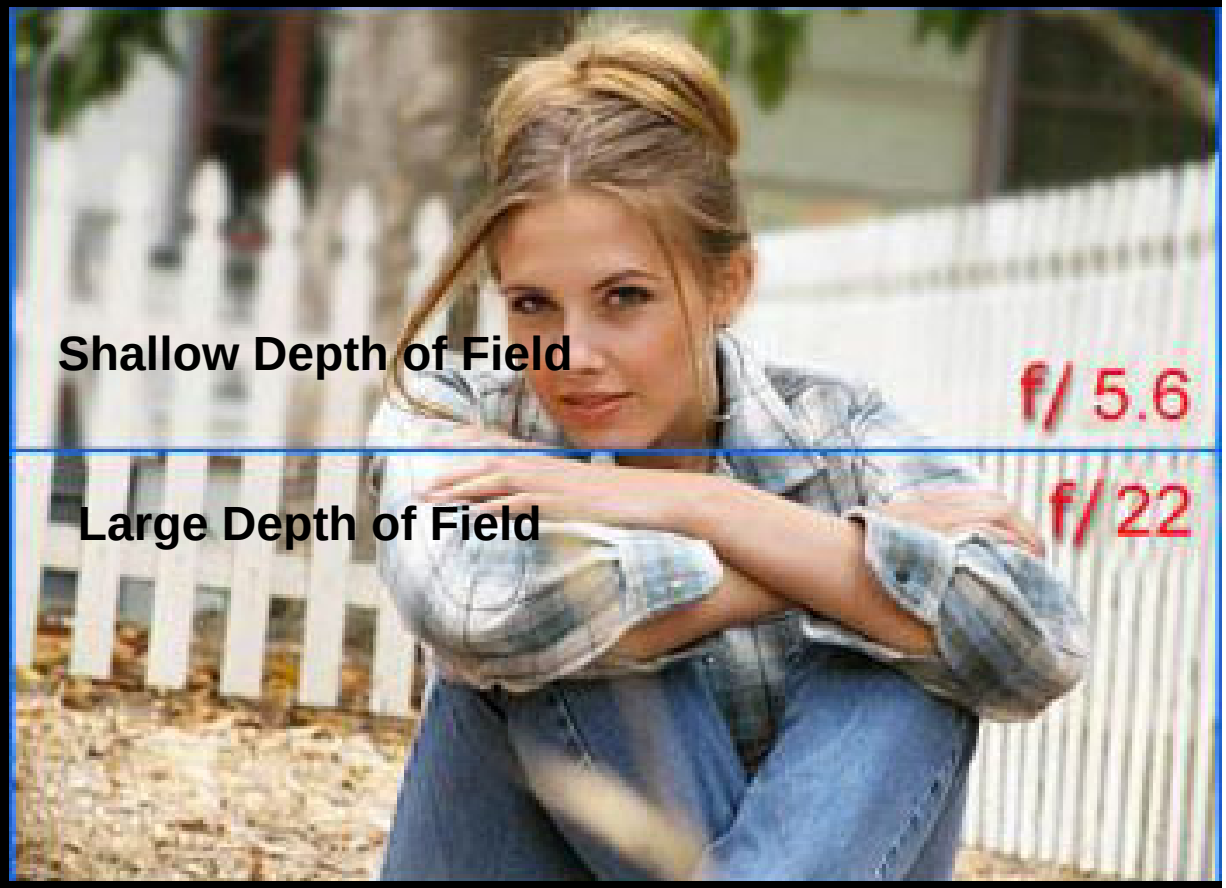
- Using a small or large aperture effects the ‘depth of field’ in your image
- This is the area of an image that appears ‘sharp’ or in focus
- A small numbered f stop e.g. f2 will give a shallow depth of field from front to back of your image, with only a narrow area in focus
- A large numbered f stop e.g. f16 will give a large area in focus from front to back of the image





Varying aperture

- Aperture allows you to concentrate your focus on a particular area of the image or to minimise distractions from another part of the image



Varying shutter speed

- Varying the shutter speed allows you to freeze or blur movement or actions
- High speeds (1/1000th sec) may be required to stop motion

  (To obtain the correct exposure may also mean that you have to use a large aperture, which will also mean that you will then have a small depth of field)

Varying exposure settings

- Most digital cameras have an ‘auto’ setting that balances the aperture and shutter speed to give what the camera thinks should be a good overall exposure
- In mixed light situations the camera may select settings which under or overexpose the image
- If your camera allows you to, set it to ***underexpose*** images, so as not to overexpose highlight areas
- Once an area is burnt out, it has gone to heaven, whereas shadows can hold latent image data that can be accessed

Varying the ISO

- Varying the ISO setting has the effect of making the CCD more sensitive to light and thus allowing photographs in lower light situations
- BUT higher ISO settings produce background '**noise**'
- Depending upon the circumstance, this may be acceptable just to get a result

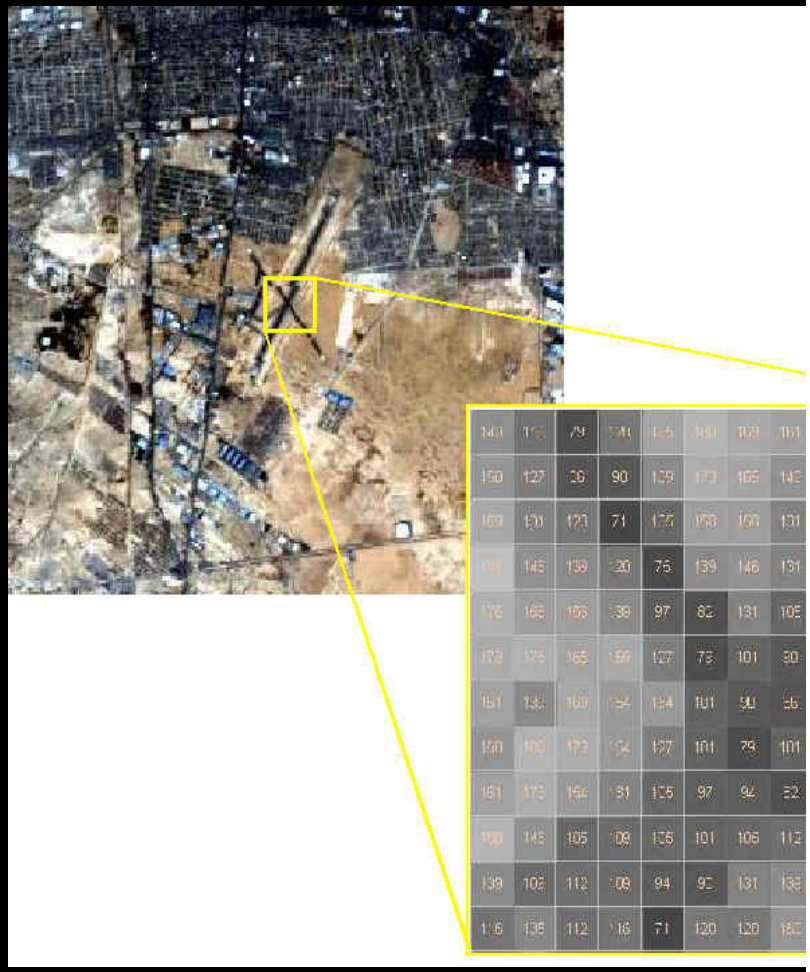
Use macro settings

- Macro settings on your camera allows the lense to recalibrate itself to alter the focus to very closeup – just the things for little specimens!
- Use it whenever possible

Your camera's resolution

- A **pixel** is the smallest object that a CCD can resolve. It looks a bit like a square on a matrix or chess board
- The resolution of digital cameras is measured in '**megapixels**' – or million pixels – this measures the numbers of pixel recorders on the CCD device

(35mm film was capable of resolving the equivalent of 20mp's)



Camera resolution *(mps aren't everything!)*

- As a rule of thumb, the bigger the lens the better the quality of the image
- Miniaturisation inevitably requires that corners are cut to balance costs. Therefore with other things being equal, a larger camera will usually provide a better image
- **Optical zoom** is the only feature that is important in lens specs – this being an optical magnification of an image via the lens
- **Digital zoom** magnifies an already captured image and actually lowers the final resolution of an image

Saving images on your camera

- Save all your photographs to the highest resolution – this means setting your camera to the highest ‘quality’ setting *(you never know when you may want that photograph to be used at maximum resolution)*
- Take as many images as you want. Often out of ten images one will stand out amongst all the others *(they don’t cost anything. Get away from the mentality of film and cost!!)* Storage space is cheaper all the time.
- Consider ‘**bracketing**’ your exposures if you require that ‘must have image’ *(overexpose/correct expose/underexpose)*
- Use **RAW** or **TIFF** format settings if you require THE very best you can get out of your camera

Post camera tasks

- Once you have taken your photographs they should be regularly transferred to your PC
- A card reader is usually faster and more convenient than direct camera to PC. *(I transfer them into folders that are named by date)*
- In a wonderful world you should also add metadata to the image *(subject/place/photographer etc)*
- **Never touch your original images!**
- Only work on, or save a copy of the original, so that if things turn to sh*t in post production then you can still go back to the original with no loss
- Make a backup on CD/DVD or portable HDD – if your PCs HDD goes to heaven so do your pics!

Post camera tasks

- You don’t all need Photoshop! ($1700!)
- Low-end software *(Corel Photopaint or Adobe Photoshop Elements)* will suffice for most users.
- Many cameras come with some variety of editing software nowadays
- Basic functions that you all should be able to perform are:
  - Adjust for correct image exposure
  - Adjust for correct colour balance
  - Adjust for correct contrast level
  - Crop the image
  - Resample *(resize)* the image

Image formats

- **JPEG** - Joint Photographic Experts Group
  - Most common
  - Able to be compressed (with subsequent loss of quality)
  - Only use the highest quality setting unless a very good reason
  - Allows many photos to be stored on cards
- **TIFF** – Tagged Image Format
  - Provides lossless quality
  - Slows camera functions
  - Occupies large storage space
  - Slow to transfer to PC
  - Loved by publishers!
- **RAW** – Cameras ultimate native format
  - As for TIFF, but allows you maximum control over your images as it records all camera settings with your image

Avoiding the shakes

- Some cameras have an anti-vibration function built-in
- A fast shutter speed will stop movement, but low light may make this impossible
- A tripod is great!
- Go for a sturdy solid model with internal bracing if possible
- If nothing else is to hand, try bracing your self against a fixed object
- Practice your breathing so that you take the photo with as little body movement as possible

Lighting for macro specimens

- Use a “studio” setup if possible *(you can then reproduce the lighting at will)*
- Use diffused lighting sources with daylight temperature *(or sunlight if nothing better!)*
- Use reflectors and non-reflective surfaces to light shadows or dull down reflections *(flash usually too harsh)*
- White, black or silver foil – try not to give colour casts to your images from backgrounds or surroundings
- A purpose made lightbox or tent is great

Taking a sharp image

- Depth-of-field is everything!
- Use tripods and small apertures, long exposures
- Use of small ISO setting
- Vary the focal length to get the best area of the specimen in focus

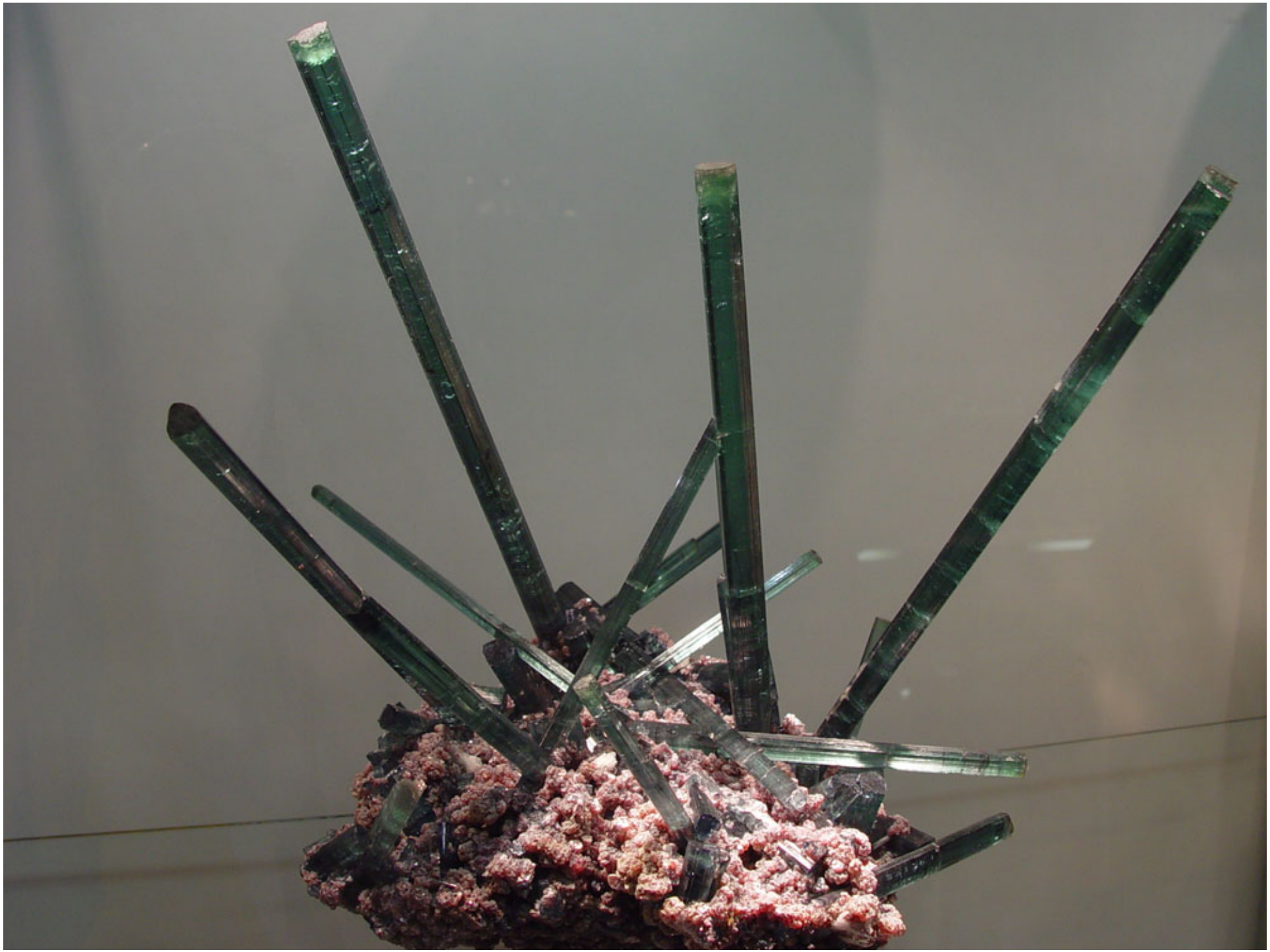
Cheat using tweaking software!

- Software can take a number of images with a very small depth of field and then combine them to increase the depth
- CombineZ is a free software that does this very well
- It can actually improve on what your eye can see!

CombineZ

- Takes a number of images with varying focal points (like pancake layers)
- Finds the common detail between each image
- Interprets them and then combines them into a single image


Go for it!




The end!