9.

Layer by layer:

Precision and accuracy in rock art recording and dating

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BACKGROUND: Informed and formal approaches in conjunction

This chapter deals with the ethnographically informed interpretation and formal stratigraphic recording of the 'Great Murals' (Crosby 1984) within Cueva de El Ratón, central Baja California, north-western Mexico (Figure 9.1). The premise of this chapter is that neither informed use of ethnography nor formal archaeological recording can, done in isolation, give an adequate picture of prehistoric rock art (Chippindale & Taçon 1998a), such as evidenced at El Ratón. Albeit essential in any empirical investigation, the mere adoption of rigorous methodologies in both informed ethnographic and formal archaeological studies is not sufficient to guarantee an accurate picture of the past. It is only when treated in conjunction that informed and formal approaches reach their full potential. Although local ethnographic records are the most logically valid starting points for analogies, the archaeological record is not a one-to-one reflection of the ethnography. Demonstrable patterns observed in the rock art record, for example, sometimes contain information not directly mentioned in the ethnography. Instead of despairing that we cannot interpret the rock art due to a lack of a perfect 'fit' with the ethnographic record, such an ostensible disjunction should be viewed more positively. Indeed, if all rock art neatly reflected the ethnography, then the best we could claim is to have learnt something about the rock art. However, if the rock art reveals convincing bits of information not

mentioned in the ethnographic record, then we can rightly claim to have learnt something from the rock art (Inskeep 1971). Herein lies the strength of rock art studies as proposed by David Lewis-Williams (1981) in his seminal *Believing and Seeing*, in which careful observations of San rock art revealed aspects not always immediately obvious in San ethnography. Ever since his early days of rock art research, Lewis-Williams (1974, 1992) advocated meticulous observation and exploration of patterns, such as superpositioning sequences. Nevertheless, as Lewis-Williams has repeatedly stated, meticulous observation alone is not adequate in the absence of a correct understanding of how ethnography and rock art are linked. It is in tribute not only to Lewis-Williams' insights concerning the subtle and often evasive relationship between ethnography and rock art, but also to his ongoing insistence on close observation and meticulous recording, that I have approached the El Ratón study.

EL RATÓN AND ITS ROCK PAINTINGS

El Ratón is a long and narrow rock shelter (66 m long, 13 m wide and 6 m high) that lies near the central and high-lying portion of the Sierra de San Francisco (*c.* 1230 m above mean sea level). The Sierra is a mountain massif of volcanic origin near the middle of the Baja peninsula (Figure 9.1). A series of deep canyons radiating from a central plateau of the Sierra characterises the topography of the area. Cueva de El Ratón, located between the uppermost reaches of the Santa Teresa canyon and the edge of the central plateau, is the highest-known painted shelter within the Sierra. Most of the Great Mural paintings occur in rock shelters located in the abundant precipitous canyon walls below El Ratón. The rock paintings, characteristically greater than life-size, on the upper back walls and ceilings of the rock shelters in the Sierra, are mostly of humans, animals, and spear-like lines; they also include smaller grid-like imagery on the lower walls. Harry Crosby (1984) notes that whereas the animals – typically deer and mountain sheep – are painted in profile and appear animated, the human figures – mostly male – face the viewer and appear static. While most animals are depicted as running with legs outstretched, virtually all humans are depicted in erect postures with their arms upraised. A few figures are clearly female, depicted with breasts below the arms. Red and black are the principal colours in both human and animal paintings, with human figures often exhibiting a sharp vertical separation between the colours. Yellow accentuates most of the comparatively small grid-like patterns in the Sierra de San Francisco. Another characteristic of the Sierra paintings is that most shelters have multiple layers of overlapping imagery. In spite of such general similarities between sites in the Sierra, each shelter is characterised by idiosyncratic elements. Within the Santa Teresa canyon, for example, Flechas rock shelter is known for its meticulous and abnormally frequent depictions of arrows and spears associated with both human and animal motifs, while El Ratón rock shelter is known for its unique depiction of a cat-like creature. Local ranchers have identified this feline creature as a big rodent (hence its name El Ratón, or 'the rat').

The large numbers and the scale of the paintings have impressed generations of visitors to the sites. Even within the elevated Sierra, the climate is semi-arid, with rainfall perhaps minimally higher than in the surrounding plains of the central peninsula (less than 100 mm of rainfall a year). Natural springs occur in the canyons and surrounding plains, creating small oases with palm trees. Vegetation in the Sierra, of the Sonoran desert type, includes cactus, agave, mesquite, and yucca. Animals typical of the area include pronghorn antelope, mule deer, mountain sheep, mountain lion/panther, and various smaller species, such as rabbit – and these are depicted in the paintings. Cueva Pintada, a large rock shelter with more images than any other site in the Sierra, contains rare depictions of birds, fish, and stingray. The marine species occur in the Pacific Ocean to the west and the Gulf of California to the east. Paintings of plants are almost completely absent. The fact that some of the massive painted images are up to nine metres above the ground has resulted in suggestions that they were done with the aid of scaffolding (local palm trees make excellent scaffolds) and/or long paintbrush handles (Crosby 1984). Whatever the technique of painting, the existence of such large images high above the ground surface and the mere effort to acquire big quantities of pigment for their completion, strongly suggest collaborative efforts and long-distance contacts among the gatherers and hunters who once inhabited the peninsula.

PEOPLE OF THE SIERRA DE SAN FRANCISCO

Gathering and hunting people have been living in the region for at least ten millennia, as attested, among other evidence, by the recovery of a Clovis-type point at an open-air site in the area (María de la Luz Gutiérrez pers. comm. 1994). Conventional and Accelerator Mass Spectrometry (AMS) radiocarbon dates from charcoal and painting implements found within Great Mural rock shelters suggest that occupation flourished between 2000 and 500 years ago (Hyland 1997). Three direct AMS measurements of the murals within El Ratón, ranging between 5000 and 1300 years ago (Fullola *et al.* 1994), are suspect for reasons discussed below (see also Loubser 1997). The archaeological record shows that the most recent gatherer-hunter occupation of the area occurred merely 500 years ago, contemporary with the initial Spanish occupation of the peninsula in the 16th century. This temporal overlap between the archaeological record and historical accounts has facilitated the use of the regional ethnography to interpret its archaeology and rock art (e.g. Grant 1974; Hyland 1997; Hyland n.d.).

Jesuit missionaries who entered central Baja California in the 18th century were the first to write extensively about the local Cochimí Indians they encountered in the region. The same missionaries also commented on the numerous rock paintings. According to one documented account (Stanley Price 1996), the Cochimí ascribed the paintings to giants who had entered the peninsula from the north. An overly literal interpretation of such a statement could be that the Cochimí did not paint the Great Murals. Yet the Cochimí statement can be interpreted in various ways; it cannot be taken as positive proof that others painted the Great Murals. Inferred denial of authorship can result from a variety of reasons, not least of which might be the desire to hide sensitive spiritual information from inquisitive missionaries. On the other hand, instead of being an outright concealment of information, the statement could actually be the informant's metaphorical allusion to the painters' status within Cochimí society. Only a more critical reading of the original Spanish document and the most likely context in which it was written may help resolve uncertainties pertaining to the statement concerning giant painters. As the Cochimí settled increasingly on the Spanish missions, their existence as independent gatherers and hunters came to an end; by the middle of the 19th century, the Cochimí had become virtually extinct (Gutiérrez *et al.* 1996).

Although no known ethnographic sources refer to the production of the rock art by the aboriginal inhabitants of Baja California, Justin Hyland (n.d.) has shown that the Great Mural paintings of the central peninsula were most probably a manifestation of a very old peninsula-wide religious complex. This ceremonial complex was principally associated with communication with the dead through the use of shamanic objects. A recurrent set of material culture objects required for performance of the religious complex has been thoroughly documented in the ethnographic record. Hyland justifiably proposes that if a similar set of material cultural remains is identified in the archaeological record, then we have empirical evidence that the complex existed in prehistoric times. Linguistic evidence indicates that Cochimí speakers once occupied the entire central portion of the Baja peninsula (Aschmann 1959). The greatest dialectical differentiation within the Cochimí language is between the extreme northern and southern edges of its occurrence. This, and other linguistic evidence not adumbrated here, suggests fairly permanent occupation of the Baja peninsula over a long period of time. Moreover, well-preserved artefacts from the dry deposits within the excavated rock shelters with Great Mural paintings suggest continuity between the prehistoric occupants and proto-historic Cochimí peoples (Meighan 1966).

Documented ethnographic observations of Baja Indian material culture dating back to the 18th century and earlier indicate that human-hair capes, wooden tablets, wooden effigy figures, smoking and sucking pipes, and feathered wands were part of the distinctive peninsular ceremonial complex related to lineage-based ancestor veneration (Hyland n.d.). Thanks to good preservation in the dry rock shelters of the Baja peninsula, similar objects have been recovered from archaeological contexts. In the ethnographic record such paraphernalia were used in a mourning ceremony intended to appease the dead founding fathers of particular lineages. During the mourning ritual, boys left the ritual items within a special structure. The bodies of participating boys were painted red and black (Meigs 1939, as quoted

by Hyland n.d.), "representing each of the deceased, as is believed are painted the spirits" (Ochoa Zazueta 1978: 253–254, as quoted by Hyland n.d.). In the presence of the painted boys, the presiding shaman would 'die'. Death in this sense explicitly referred to the shaman leaving his body while in a trance to find dead ancestors. Normally one of the dead would take possession of the shaman's body and speak in an unintelligible voice. In some instances the shamans demonstrated their communication with the spirits of the dead to the rest of the community by little wooden boards cut from the heart of the mesquite tree, "on which they have painted absurd figures, that they said copied authentically the tabla, which the visitant Spirit left them when they went to the sky" (Venegas 1943: 95). As Hyland convincingly shows, ancestor impersonation was crucial to this and other closely related ceremonies. Moreover, the deceased ancestral lineage heads were presented as shamans in various myths, so the distinction between these dead spirits and the performing shamans acting as the deceased ancestors was blurred. Taken together, then, ethnographic evidence shows that shamans and painted participants temporarily became mythical founding fathers during mourning rituals (see Turner [1995] on the concept of *communitas*, which accounts for the merging of separate time periods and individuals on ritual occasions).

Various researchers (e.g. Grant 1974) have remarked on the similarity between ethnographic descriptions of ritualised body painting and the colour divisions on the Great Mural figures. On a more specific level of interpretation, the association of idiosyncratic figures with particular rock shelters could refer to ancestors of particular lineages. Bearing in mind that 'death' was a well-documented Cochimí metaphor for entering the world of the spirits, Hyland (n.d.) suggests that the Great Mural paintings of impaled human figures with outstretched arms depict shamans and/or lineage ancestors. Furthermore, the peculiar 'headdresses' depicted in some rock paintings likely represent the hair capes used in the ancestor impersonation ceremonies. The painting of imagery on the sacred wooden boards by shamans who were inspired by dead ancestors shows that the act of painting had ritual connotations. And the crowding and multiple superpositioning of painted figures and animals in most shelters suggest that the production of imagery, rather than the creation of narrative scenes, was important (Gutiérrez *et al.* 1996).

Ethnographic descriptions show that sharing experiences in the spirit world with the rest of the community was important to the shamans, even if it required painting representations of the spirits on wooden tablets, or tabla. Evidence from the spirit world was often met with fright. For example, surprise appearances of painted boys representing the ancestors or possessed shamans talking in strange voices are reported to have scared bystanders (e.g. Ochoa Zazueta 1978, as quoted by Hyland n.d.). Similarly, it could well be that the imposing painted figures on the high walls and ceilings of the rock shelters of the Sierra were intended to intimidate the viewer. Bearing in mind the ethnographic evidence then, the characterisation of the Great Murals as 'ghostly' is probably not far off the mark.

The Great Murals are best seen when viewed from a distance, generally when approaching a rock shelter from outside. Observed from closer quarters, normally within the drip-line of a shelter, juxtaposed images become hard to separate and the viewer has difficulty recognising overall composition. Viewed at even closer quarters, a few metres from the rock face, the outlines of some bigger figures and animals become confusing. Multiple overlaps of painted figures and animals add to the confusion when viewed from too close. In the sense that they are most recognisable from a distance, Great Mural paintings resemble billboards. Particularly big figures and animals in Pintada and Palma rock shelters are clearly recognisable from the bottom of the Santa Theresa canyon, many metres below. Prehistoric gatherers and hunters travelling through the canyon must have clearly recognised from a long distance away the imposing paintings. Ethnographic evidence and idiosyncratic modes of depiction suggest that at least some of the figures represented particular lineage ancestors. It is conceivable that such lineage ancestors were painted in the shelters of their descendants.

Ethnographic observations of the gatherers and hunters of the Baja peninsula indicate that people aggregated during the summer and fall. Whereas such gatherings of dispersed bands were facilitated by the seasonal availability of a particular cactus fruit, mourning ceremonies were the primary incentive for aggregation (Aschmann 1959). Mourning ceremonies were

known to have required surplus food to feed the dead, the participants, and their families. Archaeological evidence from excavated rock shelters certainly does not contradict this scenario, as it yielded the full range of items normally associated with aggregation sites (Hyland 1997). As the monumental scale of the Great Mural paintings surely required the collaborative efforts of well-organised groups, it is tempting to speculate that the size of groups participating in mourning ceremonies and the monumental scale of the representational imagery were in fact public displays of lineage influence and prestige.

Although the vast majority of Great Mural rock art is monumental and representational, there are some smaller and inconspicuous grid-like paintings within the same rock shelters (Crosby 1984). These grids typically occur lower down the shelter walls, and tend to be the closest paintings to the shelter floor. To view these 'abstract' images properly, it is best to stand close to the rock surface or even to bend down; within Soledad rock shelter, well-preserved grids occur underneath a very low ceiling. Possibly due to the generally good condition of the grid patterns, Crosby (1984) has postulated that this "aberrant subject matter" post-dated the Great Murals. On the other hand, Hyland proposes that the grids and Great Murals are probably contemporary. While Crosby refers to comparatively small grids accentuated with a rare yellow pigment, Hyland refers to a particularly big white grid on the ceiling of El Músico shelter. When these two types of grids are compared, then the execution, size, placement, and overall appearance of Crosby's grids differ from those of Hyland's. As will be shown later in this chapter, close-up observation of the rock surface and pigment within El Ratón shelter conclusively shows that the yellow grid-like motifs actually pre-date the Giant Murals.

RECORDING METHODS AND TECHNIQUES

The rock paintings within El Ratón rock shelter were recorded during three field campaigns undertaken by the Getty Conservation Institute (GCI) in collaboration with the Instituto Nacional de Antropología e Historia, the Governorate of Baja California Sur, and Amigos de Sudcalifornia (AMISUD). The main aim of the three campaigns – conducted in the spring of 1994, 1995 and 1996 – was to record the site in its entirety and so obtain a baseline record for subsequent conservation and management actions. In order to achieve these objectives, the GCI, in consultation with its Mexican partners, decided to survey the site in its vertical and horizontal dimensions and to produce a baseline documentation of the paintings. Since the campaigns were also intended as a means to train a team of five archaeologists and conservators in rock art recording, a variety of recording techniques were employed (see Bell *et al.* [1996] for technical details).

Cueva de El Ratón posed unique recording challenges, owing to the big size, height, and extent of its Great Mural paintings, and to the highly irregular substrate of volcanic conglomerate. Conventional tracing and/or grid recording of the higher, bigger, and more uneven motifs were simply not possible. Moreover, the narrow level area within the shelter (13 m maximum) and rapid fall-off outwards precluded overall photography and total station measurements from within. After much deliberation and discussion prior to fieldwork, a camera and a total station (the latter is a computerised theodolite/transit) were placed on two rock outcrops in the valley, directly opposite the shelter, to record the overall site dimensions. Supplementary techniques of conventional recording within the shelter captured details not obvious from a distance or hidden behind boulders. Mapping of the back wall, boulders, and historic period walls was accomplished mainly through plane-table surveying during the first field campaign. More intricate details, such as the outlines and fill of the paintings, were examined from closer quarters during the second and third field campaigns. Access to the higher paintings, some up to six metres above ground level, was accomplished with the aid of scaffolds.

To facilitate recording, it was decided to divide the long El Ratón shelter into areas. Each area basically comprised a spatially distinct cluster of paintings, separated from the next cluster by an unpainted stretch of rock and/or irregularity in the rock surface, such as corners. Facing the shelter, from left to right, El Ratón shelter was divided into six main areas (A to F). Larger (Area B) and/or more irregular areas (particularly D and E) were subdivided according to the angles of the painted surfaces. During the first field campaign, each area of paintings was photographed, using colour and black-and-white film. Partly because

of surface accretions covering some paintings within the rock shelter, better illumination for colour photography was necessary. This was achieved by the use of a cross-polarising filter on the flash, placed at right angles to a similar horizontal filter on the camera lens (Bell *et al.* 1996). At this time a 1:100 site plan and a site-elevation mosaic using panoramic photographs were also completed. The site plan, photo mosaic, and close-up photographs of each area were useful reference tools during subsequent fieldwork.

Albeit precise, the use of advanced technology does not automatically ensure accuracy. This is so because precision merely implies being exact, whereas accuracy necessitates conformity with a verifiable standard. Precision concerns uncertainty in measurement, whereas accuracy concerns uncertainty in what is being measured. Since what is measured can be wrongly perceived, precise recordings are not necessarily accurate. It is also possible to be accurate without precision, as applies to some tracings. That it is indeed possible to be precise and yet inaccurate, or even 'precisely inaccurate', in rock art recording is illustrated by an example during the plotting stage of the stereophotographs in Canada after the first field campaign. A highly qualified plotter, unfamiliar with Baja rock art, was not able to plot the paintings with confidence. Cracks and discolourations on the rock surface, even when viewed in three dimensions through the stereoplotting instrument, may appear as pigment. Without rock art experience, it is possible to confuse surface anomalies with paintings. The outline of a protrusion, for example, is exact but wrong when identified as a painted motif. To ensure accuracy, one of the participants familiar with both the El Ratón paintings and the plotting instrument, Valerie Magar, spent some time in Canada meticulously plotting the painted imagery within Area B3 and parts of Area D1. Area B3 is the central and most dramatic panel within El Ratón rock shelter. Apart from areas B3 and D1, no additional stereophotographs were plotted, bearing in mind the prohibitive costs in time and labour associated with stereoplotting.

In spite of their good quality and high precision, the stereophotographs still did not match the accuracy obtained through close-up field observations. Accordingly, even after the plotting of Area B3, it was necessary to check the plots in the field during the second and third campaigns. Also, the delineation of motifs on the colour photographs needed detailed and close-up comparison with the actual rock surface. By covering each photograph with a transparent plastic sheet, it was possible to make annotated outlines and infills with colour pens. The best light conditions for recording were in the mornings, between 8 and 11 am, when the reflected sunlight from the shelter floor hit the shelter wall at a 90° angle. During other times of the day, the use of artificial halogen lights allowed recorders properly to view pigmented areas. With the aid of scaffolds, general observations made from ground level during the first field season could be checked during the second and third campaigns. All colour readings were done with a Munsell Soil Colour Chart and a Minolta Chromameter.

Comparatively small and faint red motifs, which include a rendition of a horse and rider, were located on big boulders resting on the shelter floor (Area C). The subject matter indicates that the paintings are the most recent in the shelter; they could have been painted either by the last Cochimí gatherers and hunters or by the Arce family of mixed Cochimí and European descent who once inhabited Cueva de El Ratón. The small red paintings were recorded by careful tracing with fine-tipped felt pens on transparent plastic sheets. By slightly pulling away the plastic sheets from the rock surface and applying minimal pressure with the pens, the recorders minimised contact with the pigment. Close inspection prior to tracing showed that pigment and rock surfaces were sufficiently stable to allow tracing without causing damage. Direct tracing has the advantage over photo-overlays of forcing the recorder to scan the actual three-dimensional surface in great detail. Moreover, checking tracings against the actual motifs is almost instantaneous. This makes it a far more efficient and cost-effective recording technique than working with photo-overlays. It could be argued that tracing lacks in precision, bearing in mind slight movements of the sheet, for example. Given the experience and thoroughness of a tracer in recording every single detail in true outline, however, tracings are accurate and one-to-one scaled copies that are easily verifiable by other workers in the field. Accurate tracings by recorders in El Ratón shelter showed that this technique is effective when recording fairly small paintings on stable surfaces. This point is amply illustrated by the work of Harald Pager (1971), Patricia Vinnicombe (1976) and David Lewis-Williams

(1985) in South Africa, and by James Keyser's (1977) recordings in North America.

Area B1, on the left-hand side of El Ratón shelter, comprised faint remnants of Great Mural paintings on a heavily weathered surface. The paintings were too faint for adequate recording by photography, even under cross-polarised light that captures imagery below surface crusts. It was accordingly decided to record Area B1 by means of a simple grid constructed of strings. These were carefully suspended from natural crevices and protrusions in the rock. An elegant scaled drawing by Freddy Taboada of the rock face and painted motifs showed that the technique is a viable alternative to tracing on more friable surfaces. With grid recording, however, precision is compromised by parallax. This error occurs when the same point appears in different positions depending on the angle from which it is viewed. The greater the distance between string and rock, the greater the parallax. Another disadvantage of grid recording is detailing the often complicated and uneven edges of painted areas. Basically, the smaller the unit of measurement, the more complicated the edges would appear. The fractal nature of painted edges is why bigger grids capture less detail than smaller ones.

Obviously, not everything can be recorded by any one technique. If this were indeed possible, we might be left with a very confusing picture. All recording is selective and involves decisions about what is important to know. In this sense, recording is a compromise: it involves selecting certain details at the expense of others in order to make sense of a complicated 'reality'. Basically, then, recording is goal-specific and ultimately driven by hypotheses, tacit or explicit, about the rock and the imagery. Conservators typically ask questions about deterioration rates, for example. To them, high-tech recording serves as a precise baseline to monitor deterioration. Edges of rock, drip-lines, bedding plains, joints, and pigment are considered as important baseline controls. In this paradigm, precision is a constant concern. On the other hand, archaeologists trying to understand time differences and the possible meanings of rock paintings tend to be more concerned with accuracy than precision *per se*. Intricate details concerning painted motifs and their associations with other motifs and the rock surface are usually of more importance to them than precise measurements. While it could be argued that state-of-the-art stereophotography and colour-recognition instruments yielded precise baseline documentation of El Ratón's preservation condition in 1994, these techniques did not yield reliable information concerning paint sequence.

With the exception of areas B1 and C, all the areas within Cueva de El Ratón contained superimposed painted motifs. This meant that for the purposes of properly recording the motifs, superpositioning could not be ignored. The only reliable way accurately to record superpositioning was to examine the pigment from very close, often with the aid of binocular magnifiers (20x). The use of scaffolds during the second and third field seasons enabled recorders to check tentative inferences concerning relative stratigraphy from ground level during the first field campaign. Close-up inspection showed that the brightest and best-preserved paintings were not necessarily the most recent ones. Black pigment painted over red or yellow often flaked off, creating the false impression that the red and yellow were on top, for example. In these instances, small remnant islands of black pigment, resting on a sea of red or yellow, conclusively showed that black was in fact on top. To ensure accuracy of observation, recorders double-checked the results of their colleagues. In rare cases of uncertainty, Alan Watchman gently inserted a small dental pick into the pigment to extract a cross-section of pigment layers. Viewed from the side under magnification, this 'lasagne' of pigment normally conclusively answered questions pertaining to sequence. In only one instance could layers not be separated, where black occurred on black.

Pigments within El Ratón were applied as layers in a liquid medium with a brush. As shown above, these layers were distinguished by viewing their edges and 'thickness' from the side. As an alternative to actually being at the rock face, this depth perception can be assessed by stereophotographs with very good resolution (the set-up of the cameras across the valley from the shelter precluded high-quality close-up views for photogrammetric purposes). The recording at El Ratón highlighted the importance of close-up observations in the field with the naked eye. In the final analysis, recognition of pigment and the order of its placement had to be made in front of the rock surface. In spite of technological advances, there is as yet no substitute for verification in the field.

A too-close-up focus on the rock and the pigment does not, of course, reveal interesting relationships that could exist between different motifs and natural anomalies in the rock surface. To detect aspects about motif placement and composition, it is necessary to step back and take a macro view of a site, very much as the original inhabitants most probably did. As 20th-century observers, we find it difficult, but not impossible, to imagine what was important to the gatherers and hunters of the time. By considering the ethnography of the Cochimí authors and of similar gatherers and hunters elsewhere, it becomes possible at least to look closer and consider aspects that could have been important to them. A strictly scientistic approach, emphasising precision and cutting-edge technology to the exclusion of almost everything else, tends to ignore other, ostensibly 'less precise', avenues of investigation.

Comparative ethnography and rock art studies in other parts of the world have shown beyond reasonable doubt that less obvious details, such as cracks, holes, and the placement of rock art in relation to these natural features, were important to the makers of the rock art. Even though overall photogrammetric plots at El Ratón enabled at least the rock surface to be captured on photographs that can be later viewed as three-dimensional images, staring at photographs through a stereoplotter is unfortunately no substitute for being in the rock shelter. When viewed on foot from a distance, normally at the drip-line or farther downslope, the placement of the painted panels in relation to natural features within most rock shelters of the Sierra de San Francisco becomes meaningful. Even though this macro perspective yields tantalising clues about Baja rock art in general, ignoring a micro-scale analysis of paint stratigraphy runs the risk of missing significant chronological and possible ethnographic shifts in the archaeological record. It is to this micro, or forensic, approach that the discussion now turns.

RELATIVE STRATIGRAPHY AND DATING AT EL RATÓN

Rock art archaeology has some distinctive advantages over conventional 'dirt' archaeology. One is that the researcher does not have to destroy the stratigraphy to record it. The results of a rock art stratigraphic study are accordingly open to scrutiny and replication, whereas those of archaeological excavation cannot be repeated. Another advantage of rock art studies is the ability accurately to assess relative chronology from stratigraphy. This is not necessarily the case at 'dirt' sites. Due to natural re-deposition and/or cultural reuse of archaeological soils, the topmost layer is not always the most recent one. Within archaeological sites, artefacts and charcoal notoriously move around and can enter stationary features such as pits after their use and so give a false impression of their antiquity. Over and above these problems, the more recent soil layers within rock shelters sometimes wash away, leaving wrong clues concerning chronology, such as too old a date for a site's abandonment. Inverted stratigraphy and mixing are not problems faced by the rock art archaeologist trying to reconstruct a relative chronology from painted layers, for it is simply not possible for a painted motif magically to swap its position within a sequence of superimposed motifs. If pigments contain binding mediums with carbohydrates, then it is possible that such pigments might dissolve and 'bleed' into more newly applied pigments with carbohydrates. In spite of such practical problems needing to be considered and overcome, however, rock art has the inherent potential to be a more accurate way of dating events and sequences than conventional 'dirt' archaeology (see Chippindale & Taçon 1998b).

In practice, dating methods such as direct AMS dating of pigment and/or associated crusts have not been without their problems, unfortunately. Even though advanced sample preparation and careful AMS procedures and instrumentation typically ensure high precision (Chaffee *et al.* 1993), error tends to be introduced when small samples are collected in the field or through contamination. As in the case of recording, precise measurements do not guarantee accurate results (Bowman 1990). This is illustrated in the carbon-dating attempt of pigment from El Ratón rock shelter. Prior to the GCI recording campaign, a team of Spanish archaeologists sampled at least three of the Great Murals for AMS dating (Fullola *et al.* 1994). All three pigment samples came from Area B3, the central and most imposing panel within the shelter. A red human figure with zigzags on its body near the left-hand side of the panel yielded the earliest date (5290+80 BP). The next oldest date (4810+60 BP) came from the unique black mountain lion (called El Ratón by local people) near the bottom centre of the

panel. Standard counting errors included, this estimate is 300 years older than the date from the red human figure. The youngest date (295+115 BP) came from a deer-like animal. Clearly, this date is significantly younger (i.e. by at least 4000 years) than those for the other two paintings.

As it stands, the radiocarbon chronology suggests a major chronological gap: the relatively early red human figure and mountain lion on the one hand, and the substantially later 'deer' on the other. Can there be an independent check on the ages of these motifs from El Ratón rock shelter? One control is relative chronology by means of overall paint stratification. However, no single cross-section, or profile, drawing through a complicated rock art panel with its varying stratigraphy can be taken as representative. The challenge is to find the best way of recording and representing a complicated three-dimensional sequence on paper. The historical archaeologist, Edward Harris, solved this problem while working on intricate urban sites by developing the Harris Diagram (Harris 1989). Whereas South African researchers such as Lewis-Williams (1974, 1992) and Vinnicombe (1976) had systematically considered paint stratigraphy in their studies, Christopher Chippindale and Paul Taçon (1993) were the first archaeologists known to have applied the Harris method to complicated rock art stratigraphy in Australia; they were soon followed by Jannie Loubser (1993) in South Africa. More detailed discussions on compiling Harris diagrams and appropriate 'reduction rules' appear in Edward Harris and colleagues (1993) and Clive Orton (1980).

Harris notes that the directly observed stratigraphic relationship between any two motifs can have only the following four permutations:

- motif A is underneath motif B: A is earlier than B;
- motif A is on top of motif B: A is later than B;
- motifs A and B are in the same layer: A and B are contemporary;
- no relationship exists between motifs A and B: unknown time differences between A and B.

Once the direct relations between any pairs of rock art motif have been recorded, it is possible to compile a master diagram of the overall sequence. The master sequence can be simplified by using certain 'reduction rules'. For example, the 'transitive rule' states that if A is on top of B and B is on top of C, then A can be said to be later than C. The 'anti-symmetric' rule states that if A is on top of B in one instance, but B is on top of A in another, then A and B are contemporary. Use of the Harris method in this fashion enabled the reconstruction of both the internal stratigraphy of individual polychrome paintings and the stratigraphic relationship between different paintings, both mono- and polychrome, within El Ratón. Natural layers were also included in a Harris Diagram where their position in the overall sequence could be determined. The general painting sequence is now described (Figures 9.2–9.4), starting with the earliest.

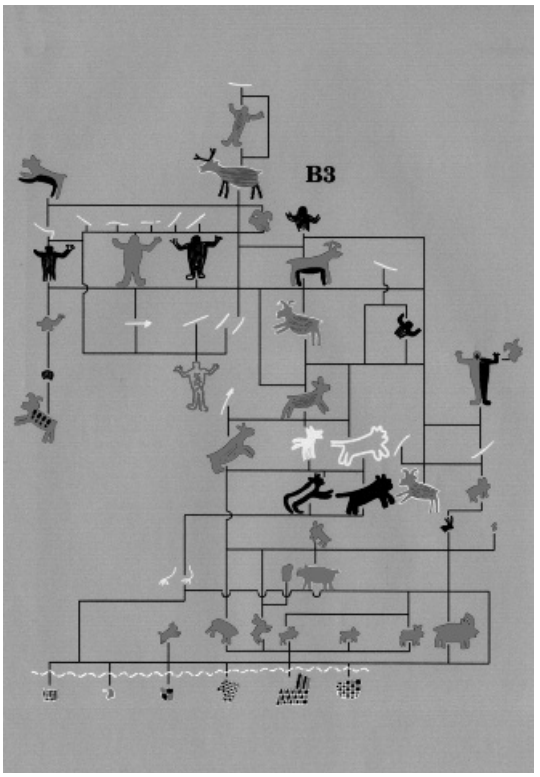

FIGURE 9.2 Direct stratigraphic relationships between motifs in Area B3. Internal stratigraphy of individual motifs not shown unless separated by other motifs. Calcium oxalate layer shown by wavy line. Not to scale.

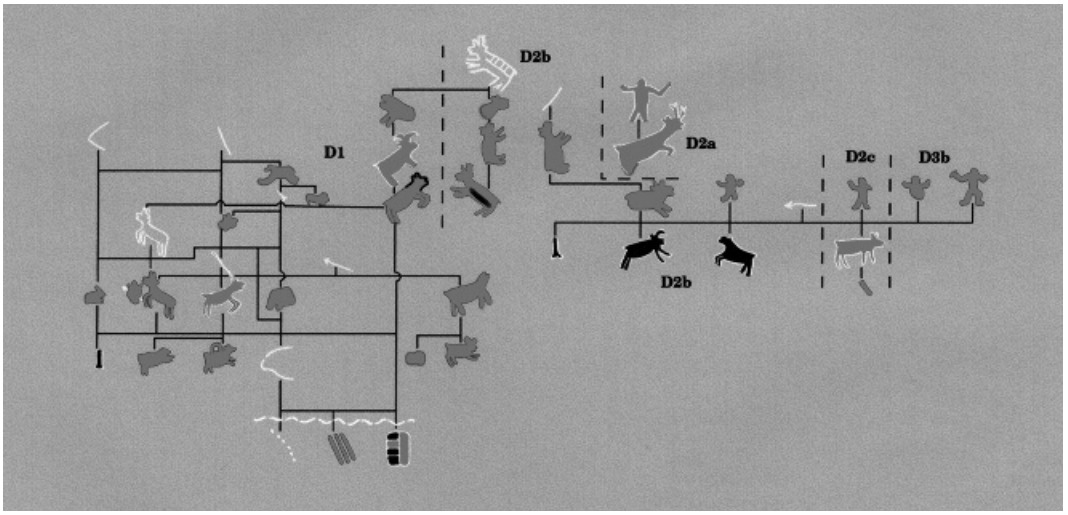

FIGURE 9.3 Direct stratigraphic relationships between motifs in areas D1, D2a, D2b, D2c and D3b. Internal stratigraphy of individual motifs not shown unless separated by other motifs. Calcium oxalate layer shown by wavy line. Not to scale.

The six checkerboard patterns identified in the shelter, five from Area B1 and one from Area D1, are the earliest in the sequence (Figures 9.2, 9.3). Most checkerboards consist of black and red blocks, yellow grids and white dots. The black paint was applied first, with a yellow grid carefully painted over the black with a fine brush (Figure 9.5). Red squares were then added, sometimes directly on top of the black. Finally, white dots were applied in an apparently haphazard fashion, most likely with the tip of a finger. A relatively thick encrustation of a pale grey translucent material covers the checkerboards in both areas B1 and D1. This opaque layer could be a 'horizon marker' that separates the checkerboards from the rest of the paintings. Arie Wallert, analytical chemist on the third field campaign, determined through spot tests that the opaque layer in Area B3 contained calcium oxalate salts. This implies that it is possible to date the layer by AMS and so to obtain a minimum date for the checkerboards and yellow grids (Watchman & Campbell 1996). The pertinent point, however, is that calcium oxalate was deposited on top of the checkerboard/yellow grid motifs at some period within El Ratón rock shelter. This opaque layer effectively sealed and separated the yellow grids from subsequent paintings. Protection against weathering afforded by the natural layer could explain why the yellow grids are in good condition when compared with subsequent representational images.

This natural layer dividing paintings in El Ratón, and very likely at other sites in the Sierra de San Francisco (pers. obs.), strongly suggests that a chronological gap exists between the abstract grids and the more representational imagery associated with the Great Murals; combining the yellow grids with the Great Murals is flawed, and may have repercussions for interpretation. It is very likely that the early abstract grids represent a somewhat different painting tradition than the representational Great Murals. Stratigraphic observations at other shelters in the Sierra may confirm or refute this hypothesis. At present, it is safe to say that the grid form does continue into the Great Mural tradition, since the bodies of animals and humans are often depicted as grids, for example. Also, the big white grid in El Músico shelter could be part of this

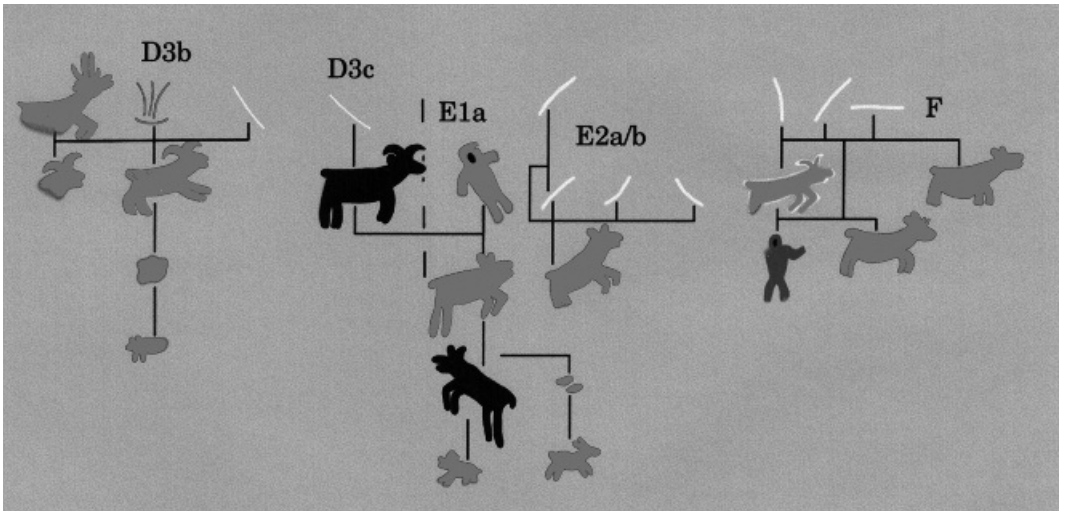

FIGURE 9.4 Direct stratigraphic relationship between motifs in areas D3b, D3c, E1a, E2a/b and F. Internal stratigraphy of individual motifs not shown. Not to scale.

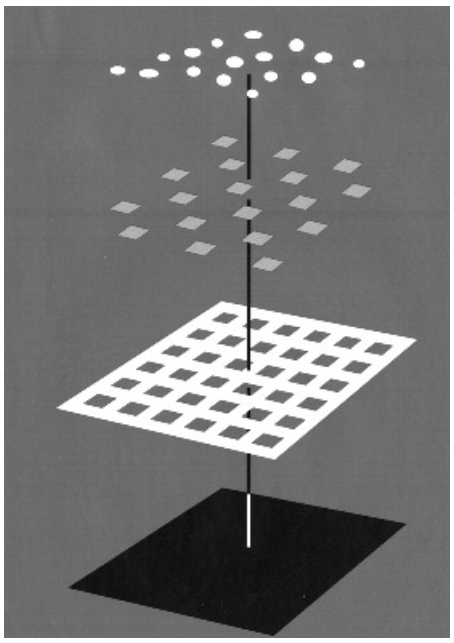

FIGURE 9.5 Typical internal stratigraphy of a checkerboard-like motif in Area B3. Not to scale.

continued use. Nevertheless, within El Ratón, yellow grids and checkerboards are consistently at the bottom of the sequence, not far from the shelter floor.

Painted on top of the checkerboard and the translucent layer in El Ratón is a series of small red rabbit-like and deer-like animals (Figures 9.2, 9.3). Only some of these small animals have traces of a white outline (Figure 9.6). Among the small animals are a few bigger ungulates that are painted in red and outlined in white. Due to extensive superimpositioning by later figures, the identity of these animals is not always clear. However, at least some resemble mountain sheep and deer, animals typical of the Great Mural tradition. In Area B3, two small rabbit-like animals are painted on top of bigger ungulate-like animals (Figure 9.2); so by the 'anti-symmetric rule', small animals are contemporary with the bigger ones. The small red animals and bigger red ungulates are generally painted in the same location as the earlier yellow grids, not high above the shelter floor. Within Area B3, these red animal paintings tend to be placed higher up against the back wall of the shelter than the yellow grids.

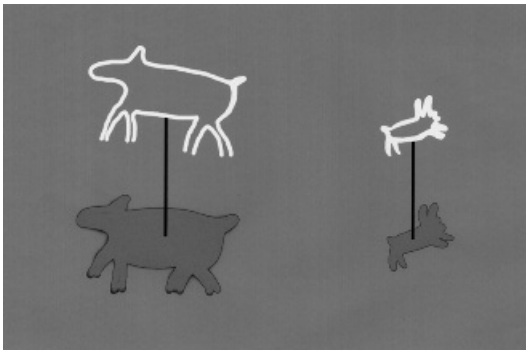

FIGURE 9.6 Typical internal stratigraphy of rabbit-like and deer-like animals. Not to scale.

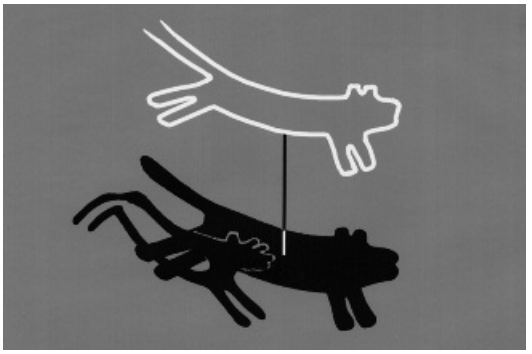

FIGURE 9.7 Stratigraphic relationship between the 'mountain lion' and 'deer' in Area B3. Not to scale.

Painted on top of the small red rabbit-like and deer-like animals are the bodies of the black mountain lion and an overlapping deer-like animal (Figure 9.2). It is virtually impossible to distinguish between the black pigment of the mountain lion and that of the 'deer' (Figure 9.7). The white outline of the mountain lion is on top of both the mountain lion and a 'deer', suggesting that the mountain lion is the later of the two animals. Other examples in the shelter illustrate that outlines are actually separated stratigraphically from the 'solid' figure they outline by other motifs, so they cannot be assumed to be roughly contemporary. Whatever the case, both lion and 'deer' are sandwiched by the same motifs and should be roughly contemporary. In the light of their relative stratigraphic contemporaneity, the time difference of four millennia in radiocarbon years between the two motifs is curious.

Seven layers of painted motifs occur on top of the lion outline and the 'deer' (Figure 9.2). These later layers also possibly include the red human figure that pre-dates the 'deer' in terms of radiocarbon years! Unfortunately, no painted motifs separate the lion and 'deer' motifs from the red human, so the possibility that the human is older than the lion and 'deer' cannot be ruled out with any degree of confidence. It is difficult to determine the cause of the discrepancy between the radiocarbon dates and the relative sequence. One reason could be that samples included multiple pigment layers and surface crusts with organic content that skewed the date. Spot tests conducted by Wallert indicated that calcium oxalate did indeed occur in accretions at the site. The relatively recent date for the 'deer', for example, could have been derived from younger carbon-bearing crusts. There is unfortunately no way positively to identify the specific problems, as we have no information on the collection techniques and locations chosen by the Spanish team. If multiple layers were indeed sampled, then the dates are merely a mean estimate of the radiocarbon content. At least we know that the assessment of painted layers is accurate; it is possible for relative chronologies to be right and absolute dates to be wrong.

The Harris Diagram shows that paintings of human beings tend to occur relatively later in the sequence than those of mountain lion. In other painted areas of the shelter, humans also appear later in the relative sequence. In general, humans are normally painted on top of animals, rather than the other way around. However, in Area B3 at least two human figures occur under animals (Figure 9.2), and in Area E2a/b, a

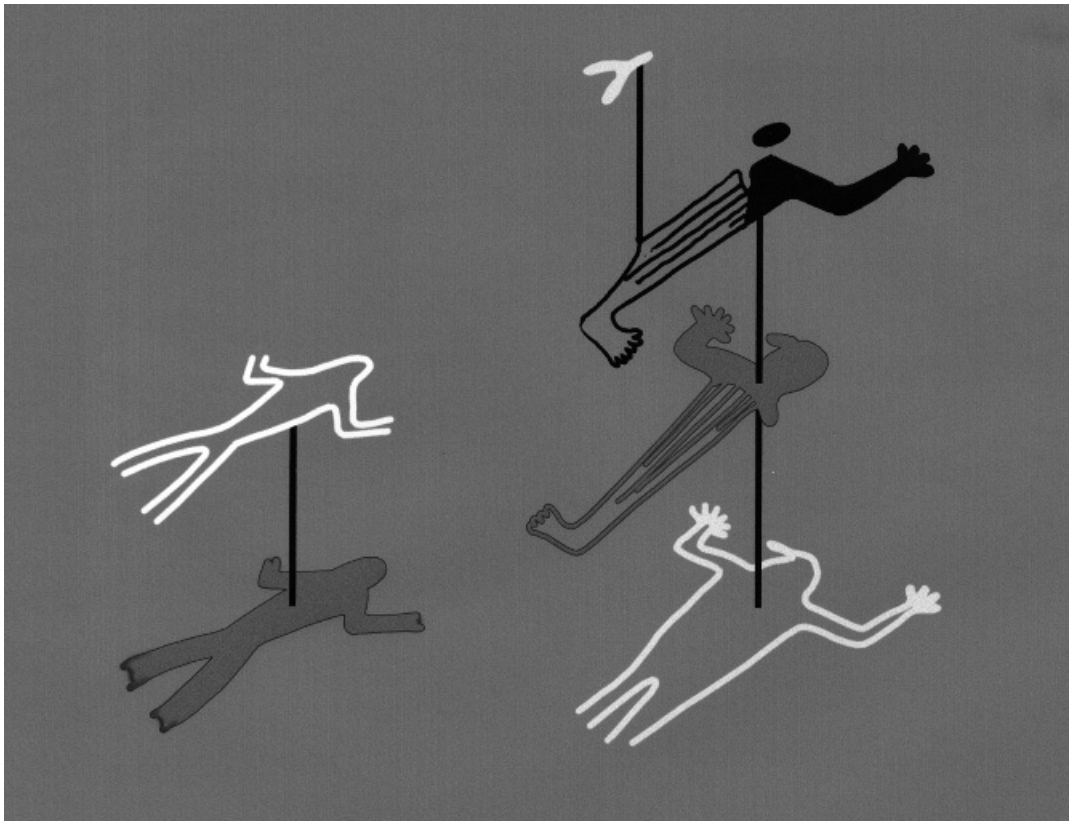

FIGURE 9.8 Typical internal stratigraphy of human paintings (left) and human paintings with black faces (right). Not to scale.

human is under a mountain sheep (Figure 9.4). These 'anti-symmetric' relations between humans and animals show that they are contemporary.

As in the case of animal paintings, the bodies of the majority of humans are painted first and are then outlined (Figure 9.8). The two exceptions to this rule are human figures, both with black faces; these were done in outline first before their bodies were filled with paint (Figure 9.8). They occur towards the later part of their respective sequences. The bigger and more elaborate figures and animals tend to be placed higher against the back walls and ceiling of El Ratón. The only clear depiction of a female figure is also one of the latest and highest motifs in the shelters. In terms of placement, size, detail, and ethnographic accounts above, it is very likely that at least some females were prominent in ancestor veneration ceremonies. A massive deer is painted immediately under and below the female figure.

The painting of two polychrome mountain sheep in the upper left-hand side of Area B3 shows signs of repainting or, more specifically, re-outlining (Figure 9.9). A checkerboard pattern has been painted on the solid red body of the first mountain sheep. Painted on top of the checkerboard is a series of black lines resembling the hair cape found on human paintings. On top

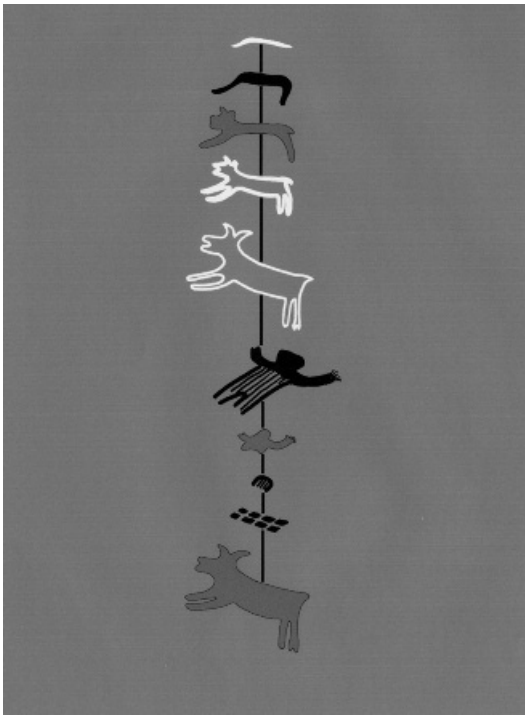

FIGURE 9.9 Internal stratigraphy of two mountain sheep in Area B3. Note that two human figures are sandwiched within the lower sheep. Not to scale.

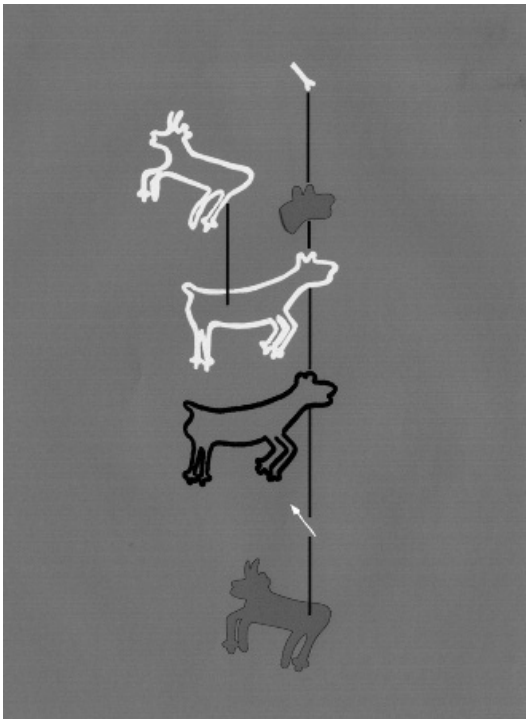

FIGURE 9.10 Internal stratigraphy of two deer-like animals in Area D1. Note that the one animal is sandwiched within the other. Not to scale.

of this hair cape is the upper torso of a human figure in red. A fairly complete human in black is painted on top of this red figure. It is only after the completion of this black figure that the red mountain sheep was finally outlined in white. The white outline of the second mountain sheep occurs on top of the white outline of the first, indicating that it was painted later. Within the white outline of the second mountain sheep was first painted a red head and back and then a belly in black. A streak of white paint on the line that horizontally divides its body occurs on top of all the other colours. Evidence for repainting then indicates that the painter(s) came back to accentuate both mountain sheep.

Similar accentuation of two deer-like animals is apparent in Area D1 (Figure 9.10). Here a white 'arrow' covers the buttocks of the first red deer-like animal. The black outline of the second deer-like animal's face and neck covers the spear. A white line accentuates the black outline of the second 'deer'. Red pigment has been added to the face of this 'deer'. Only after the re-outlining of the second 'deer' in white did the painter(s) outline the first 'deer' with white. A white line, resembling the rear end of an arrow, is painted on top of the red head of the first 'deer'. This shows that three layers of painting separate the apparent repainting of the 'arrow'.

The final example of re-outlining comes from Area D2b (Figure 9.11). Here, the body of a big red and black deer is covered by two red animal paintings, while its white outline covers the same two red animals.

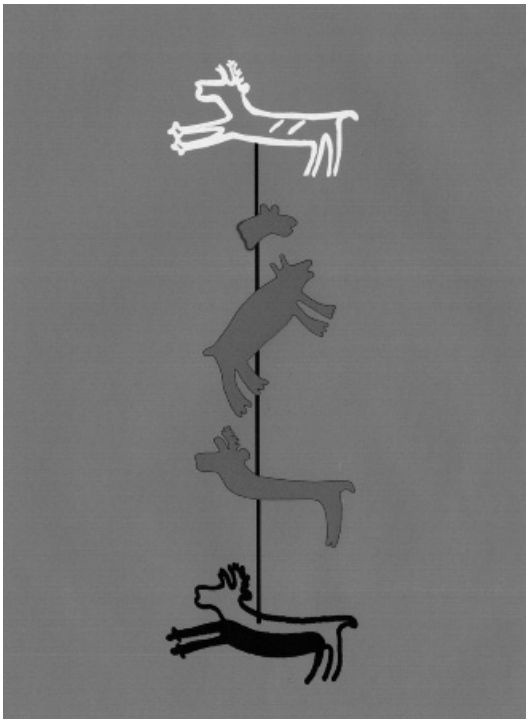

FIGURE 9.11 Internal stratigraphy of a deer-like animal incorporating two other animal paintings in Area D2b. Not to scale.

White lines resembling spears normally cover animals and humans. However, animals and humans also cover spears in a few instances. By the 'anti-symmetric' rule, then, animals, humans, and spears are contemporary. Spears are painted mostly in white, but a few are red. With only a few exceptions, spears tend to be painted last in the sequence of all the areas with superpositioning. Like the more prominent animals and humans, spears also tend to be located high on the back walls and ceiling of El Ratón shelter. No spears are covered by the smaller red animal motifs near the bottom of the sequence and closer to the shelter floor.

The white pigment of spears is often coloured pink or orange where they cross the red of other figures. Spot tests of white pigments done by Wallert show the presence of carbohydrates, a fact that may account for its solubility when in contact with newly applied carbohydrates, even long after initial application. Unfortunately, the 'bleeding' of pigments is not conclusive evidence for a short time lapse between the applications of different motifs. Apart from the checkerboards with yellow grids, there is no evidence for stylistic or stratigraphic distinctions in the Cueva de El Ratón to suggest temporal differences. Virtually identical motifs often occur in different layers within the relative sequence. For example, two layers of paintings separate a pair of mountain sheep in Area B3 (Figure 9.2). Stratigraphic separation of such identical motifs suggests fairly rapid intervals between the applications of the different layers.

PROVISIONAL SEQUENCE AT EL RATÓN AND SOME IMPLICATIONS FOR INTERPRETATION

Overall, then, pigment layers in El Ratón show that early checkerboards with yellow grids are separated by a thin opaque calcium oxalate layer from the Great Mural paintings. This is not to deny that less visible mineral layers are sandwiched between other paintings within the shelter. Less obvious layers can probably only be detected with electron microscope analysis of thin cross-sections taken from selected areas. What appears in this summary is only the broad sequence apparent at 20x magnification (Figure 9.12). It is indeed likely that a more precise physical examination of the micro stratigraphy may reveal additional details that could be informative about the paintings and their sequence of application.

Following the grids in the relative chronology of El Ratón shelter are red paintings of comparatively small animals. These mostly resemble rabbit-like or juvenile deer-like animals, although a few bigger depictions could represent adult ungulates. Although the bigger paintings tend to be on top of the smaller ones, the presence of a few 'rabbits' on top of ungulates shows them to be contemporary by the 'anti-symmetric' rule (Figure 9.12). The 'rabbits' and small ungulates have a similar appearance; both are done in solid red. Some of the well-preserved ones are outlined in white.

Painted on top of these smaller animals are bigger and more elaborate ones, sometimes done as polychromes. Associated with the bigger animals are

human figures and spears. Although human figures tend to be later than the animals, and spears tend to be later than human figures, the 'anti-symmetric' relationship between these three motifs shows that they are contemporary. Figure 9.12 is a convenient summary of the paintings at Cueva de El Ratón. This summary should considerably simplify comparison with sequences from nearby painted shelters in the Sierra de San Francisco. In this step-by-step fashion a regional chronology can be constructed, very much like a lithic and/or ceramic sequence in conventional 'dirt' archaeology. Since El Ratón is still the only shelter with a relative sequence in Baja, it is not possible at this stage to make any claims as to the regional validity and possible chronological division between the smaller bichrome animals and the bigger polychrome animals and humans.

The early grids and the earlier representational paintings occur comparatively low on the back wall of the El Ratón shelter, particularly in Area B3. The Great Murals seem to exhibit a trend towards bigger and more elaborate animals and humans later in the relative sequence. These progressively later motifs also tend to occur higher against the ceiling of the shelter.

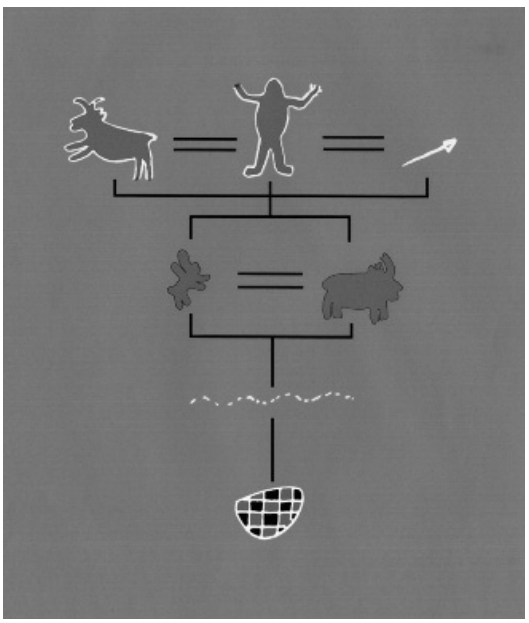

FIGURE 9.12 Summary of painting sequence within Cueva de El Ratón. Not to scale.

At this stage of research we can confidently state that within El Ratón there are at least two painting episodes: an early geometric one followed by representational paintings. By comparative ethnography and research on neuropsychology, Hyland (n.d.) justifiably identifies the grids as entoptics. In terms of the Lewis-Williams and Dowson (1988) model, this implies that the earlier 'grid episode' was a portrayal of only 'early-stage' visions, whereas subsequent iconic imagery portrayed later stages of trance visions. If the grids and the iconic imagery were indeed contemporary, this could have been construed as a neat graphic representation of the stages of trance-generated imagery. However, in the light of evidence for chronological separation, a shift in the kind of shamanic activity and trance vision through the course of Cochimí prehistory is probably a more fruitful avenue of investigation.

One way of determining the time lapse between the grids and the representational paintings is to sample and date at least the following three micro layers: pigment from the grid, calcium oxalate from the opaque layer, and pigment from the small red animals. Based on results from the Victoria River District in northern Australia, Alan Watchman (pers. comm. 1999) estimates that the distinct oxalate layer within El Ratón may have taken between 1000 and 3000 years to form. If this estimate is valid, then the time gap between grids and representational imagery is sufficiently significant to take into consideration possible shifts in ritual activity. Of course, chronological differences alone do not signify change in cultural practices. However, if time differences can be shown to coincide with visible changes in material remains, then cultural changes cannot be denied.

PLACEMENT AND DEPICTION OF MOTIFS IN EL RATÓN

It is easy to get enmeshed in the intricacies of painting details during recording and so to miss the greater picture. Standing back within El Ratón rock shelter towards the end of the third and last recording cam-

paign in Baja California, I made an observation that should have been obvious earlier on. For the first time I realised the possible significance of the central and most imposing panel, Area B3, being located directly above a small alcove at the bottom of the back wall. The early yellow grids and subsequent small red animals were clustered directly above this alcove. Farther up the back wall and ceiling of the shelter were progressively later and more widely spaced humans and animals. These images were clearly arranged in an open U-shape. From an admittedly European perspective, it was as if the images came bursting out of the alcove. Great was my surprise when I realised that the painted areas to the right of this alcove exhibited a related pattern. Areas D1 to F are located progressively farther away from the alcove, Area D2b marking the corner that turns away from the alcove. In each of these panels, images that are spatially closer to the alcove also tend to be earlier in the sequence. Clearly, then, the painters first focused on the area around the alcove and then progressively moved away from it. This recalls the emergence theme identified in the rock art of gatherers and hunters on an international scale (e.g. Whitley 1998).

An additional hint at 'emergence' comes from the partial painting of many animal and human motifs. Only the heads of some mountain sheep are painted, and the hind legs of many other animals are left out. These incomplete portions of the animals are not due to weathering, as can be attested by close-up examination of the rock surface. Instead, the bodies or lower extremities of these animals were simply not painted. The lower bodies and legs of some human figures were similarly left out. Moreover, Area D3b contains a depiction of a deer with its hind legs partly inside a natural hole in the rock. Viewed from a distance, these partially painted images appear to emerge from the rock. Lower down the Santa Teresa canyon, huge figures with outstretched arms in the main panel at Cueva Pintada also appear to emerge from behind boulders at the bottom of the shelter wall. In the light of ethnography from the Baja peninsula, this could have been an apt way to illustrate trance apparitions of ancestors during mourning ceremonies. In the absence of ethnographically informed theory, these aspects of the paintings would have been overlooked.

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References

Aschmann, H. 1959. *The Central Desert of Baja California: Demography and Ecology*. Berkeley (CA): University of California Press, Ibero-Americana 42.

Bell, J., Jérôme, J-P., Sawyer, P., Magar V. & Stanley Price, N. 1996. Stereophotogrammetric recording of rock art at the Cueva de El Ratón, Baja California, Mexico. *ICOM Committee for Conservation* 1: 454–457.

Bowman, S. 1990. *Radiocarbon Dating*. Berkeley (CA): University of California Press.

Chaffee, S.D., Hyman, M. & Rowe, M.W. 1993. Direct dating of pictographs. *American Indian Rock Art* 19: 23–30.

Chippindale, C. & Taçon, P.S.C. 1993. Two old painted panels from Kakadu: variation and sequence in Arnhem Land rock art. In: Steinbring, J., Watchman, A., Faulstich, P. & Taçon, P.S.C. (eds) *Time and Space: Dating and Spatial Considerations in Rock Art Research: Papers of Symposia F and E, AURA Congress Cairns 1992*: 32–56. Melbourne: Australian Rock Art Research Association, Occasional AURA Publication 8.

Chippindale, C. & Taçon, P.S.C. (eds) 1998a. *The Archaeology of Rock-Art*. Cambridge: Cambridge University Press.

Chippindale, C. & Taçon, P.S.C. 1998b. The many ways of dating Arnhem Land rock art, north Australia. In: Chippindale, C. & Taçon, P.S.C. (eds) *The Archaeology of Rock-Art*: 90–111. Cambridge: Cambridge University Press.

Crosby, H. 1984. *The Cave Paintings of Baja California: The Great Murals of an Unknown People*. Revised edition. La Jolla (CA): Copley Books.

Fullola, J.M., Castillo, V., Petit, M.A. & Rubio, A. 1994. The first rock art datings in Lower California (Mexico). *International Newsletter on Rock Art* 9: 1–4.

Grant, C. 1974. *Rock Art of Baja California*. Los Angeles (CA): Dawson's Book Shop.

Gutiérrez, M.L., Hambleton, E., Hyland, J. & Stanley Price, N. 1996. The management of World Heritage sites in remote areas: the Sierra de San Francisco, Baja California, Mexico. *Conservation and Management of Archaeological Sites* 1: 209–225.

Harris, E.C. 1989. *Principles of Archaeological Stratigraphy*. London: Academic Press.

Harris, E.C., Marley R.B. III & Brown, G.J. (eds) 1993. *Practices of Archaeological Stratigraphy*. London: Academic Press.

Hyland, J.R. 1997. Image, land, and lineage: hunter-gatherer archaeology in central Baja California, Mexico. Unpublished PhD thesis. Berkeley (CA): University of California, Department of Anthropology.

Hyland, J.R. n.d. Talking with the dead: context, continuity, and the Great Mural tradition of Baja California.

Inskeep, R.R. 1971. The future of rock art studies in southern Africa. In: Schoonraad, M. (ed.) *Rock Paintings of Southern Africa*. Johannesburg: South African Journal of Science Special Issue 2: 101–104.

Keyser, J.D. 1977. Writing-on-stone: rock art on the Northwestern Plains. *Canadian Journal of Archaeology* 1: 15–80.

Lewis-Williams, J.D. 1974. Superpositioning in a sample of rock paintings in the Barkly East District. *South African Archaeological Bulletin* 29: 93–103.

Lewis-Williams, J.D. 1981. *Believing and Seeing: Symbolic Meanings in Southern San Rock Paintings*. London: Academic Press.

Lewis-Williams, J.D. 1985. Rock art recording and interpretation in the Harrismith District. Unpublished report submitted to the HSRC. Johannesburg: University of the Witwatersrand.

Lewis-Williams, J.D. 1992. *Vision, Power and Dance: The Genesis of a Southern African Rock Art Panel.* Amsterdam: Stichting Nederlands Museum Voor Anthropologie en Praehistorie, Veertiende Kroon-Voordracht.

Lewis-Williams, J.D. & Dowson, T.A. 1988. The signs of all times: entoptic phenomena in Upper Palaeolithic art. *Current Anthropology* 29: 201–245.

Loubser, J.H.N. 1993. A guide to the rock paintings of Tandjesberg. *Navorsinge van die Nasionale Museum, Bloemfontein* 9(11): 345–384.

Loubser, J.H.N. 1997. The use of Harris diagrams in recording, conserving, and interpreting rock paintings. *International Newsletter On Rock Art* 18: 14–21.

Meighan, C.W. 1966. Prehistoric rock paintings in Baja California. *American Antiquity* 31: 372–392.

Meigs, P. 1939. *The Kiliwa Indians of Lower California.* Berkeley (CA): University of California Press, Ibero-Americana 15.

Ochoa Zazueta, J.A. 1978. *Los Kiliwa y el Mundo Se Hizo Así.* Mexico City: Instituto Nacional Indigenista.

Orton, C. 1980. *Mathematics in Archaeology.* London: Collins.

Pager, H.L. 1971. *Ndedema.* Graz: Akademische Druck.

Stanley Price, N. 1996. The Great Murals: conserving the rock art of Baja California. *Conservation: The Getty Conservation Institute Newsletter* 11(2): 4–9.

Turner, V.W. 1995. *The Ritual Process: Structure and Anti-structure.* New York (NY): Aldine de Gruyter.

Venegas, M. 1943. *Noticia de la California y de su Conquista Temporal y Spiritual, 1739.* Mexico City: Editorial Layac.

Vinnicombe, P. 1976. *People of the Eland: Rock Paintings of the Drakensberg Bushmen as a Reflection of Their Life and Thought.* Pietermaritzburg: University of Natal Press.

Watchman, A. & Campbell, J. 1996. Micro-stratigraphic analyses of laminated oxalate crusts in northern Australia. In: Realini, M. & Toniolo, L. (eds) *Proceedings of the 2nd International Symposium on the Oxalate Films in the Conservation of Works of Art*: 409–535. Milan: CNR Gino Bozza, Politecnico di Milano.

Whitley, D.S. 1998. Finding rain in the desert: landscape, gender and far western North American rock art. In: Chippindale, C. & Taçon, P.S.C. (eds) *The Archaeology of Rock-Art*: 11–29. Cambridge: Cambridge University Press.