The American Archaeologist: Results of the 1994 SAA Census (Redux)

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Contents

- Editor's Note
- Trends in Archaeological Research
- Trends in Publication and Professional Activities
- Trends in Archaeological Funding
- Ongoing Trends and Open Questions
- Gender Trends in American Archaeology
- Impact of the Private Sector Growth on American Archaeology

Editor's Note: This is the second part of a series summarizing the results of a 1994 census conducted by SAA of its members and other archaeologists. The complete census results will be published by AltaMira press later this year as The American Archaeologist: A Profile. This article summarizes chapters 5 through 8 and concentrates on archaeological research interests, publication and professional activities, and archaeological funding.

Trends in Archaeological Research

The subject matter of American archaeology is the focus of Chapter 5, "Archaeological Research in the Americas." What regions of the world are American archaeologists most interested in studying? What questions do they ask, and how do they frame these questions? What theoretical and methodological approaches do they use? While we have seen that the education, employment, and the family lives of men and women archaeologists often follow very different trajectories, gender seemingly plays only a limited role in shaping research interests. Women, however, tend to focus on complex societies and historic periods, while men are more drawn to the study of Paleolithic and early Neolithic cultures. Gender studies, in particular, are the almost exclusive domain of women
archaeologists. Women also tend to subscribe to schools that can be grouped under the rubric of "postprocessualism"; men, on the other hand, are more drawn to "processual" approaches to archaeology.

Other factors have a greater impact on determining the kinds of questions archaeologists study and how they conduct their research. Age, for example, is more important than gender in determining an archaeologist's allegiance to a particular archaeological paradigm (Figure 1). Culture historical approaches show a sharp decline among younger men and women, as does, to a lesser extent, archaeology grounded in cultural ecology. And while there are gender-based differences in the degree to which processual and postprocessual paradigms are followed, both approaches show a steady increase among younger men and women.

Figure 1

Figure 1: Age-related trends in archaeological paradigms for those who subscribe to culture historical (a), cultural ecological (b), processual (c), and postprocessual (d) approaches. While culture historical approaches show a steady decline among younger archaeologists, and cultural ecological approaches decline among archaeologists in their twenties, both processual and postprocessual approaches show a marked increase among younger cohorts. Postprocessual approaches particularly appeal to women, while processual approaches are best represented among men.
Age-related trends also are apparent. For instance, younger archaeologists are pursuing zooarchaeological research in greater numbers, but are less engaged in ceramic and lithic analysis. And not surprisingly, archaeologists working in North America often reside in the area of their interest.

But by far the most important factor shaping archaeological research interests is the work setting. The four primary employment sectors that have been recognized are: academia, government, museum, and the private sector. Academics, in particular, stand apart from archaeologists in all other employment sectors in their regional, topical, theoretical, and analytical approaches to archaeology. Specifically, academics tend to have a broader regional focus in their work (Figure 2), they tend to specialize in prehistoric rather than historic archaeology (Figure 3), they are more drawn to processual and postprocessual paradigms (Figure 4), and they rely more on ethnology as a crossdisciplinary reference for their work. Archaeologists in the government and private sectors practice archaeology very differently, and while museum archaeologists resemble academics in several aspects, they too have a distinctive profile of research interests and approaches. These data echo patterns discussed in Chapter 4, on archaeological employment, which revealed distinctions in day-to-day activities by archaeologists in academia when compared to those in other employment sectors.

**Figure 2**

Figure 2: Proportions of archaeologists in different employment sectors whose primary regional interests lie in North America (NA), Latin America (LA), or the Old World (OW). Academics, museum professionals, and students are more likely to work outside North America than archaeologists in the government or private sector, who focus more exclusively on North American archaeology.
Figure 3. Proportions of archaeologists in different employment sectors whose research tends to focus on prehistoric (PH) or historic (H) archaeology, archaeological theory (T) or methods (M). Here academics and students have a particularly strong emphasis on prehistoric archaeology, while historic archaeology is better represented among government, museum, and private sector archaeologists. Museum and private sector archaeologists tend to focus more on methodological interests, while academics, government archaeologists, and, especially, students stress theory building.

Figure 4. Proportions of archaeologists in different employment sectors who work within the framework of culture historical (CH), cultural ecological (CE), processual (P), and postprocessual (PP) paradigms, showing the strong resemblance between academics and students. Postprocessual paradigms are particularly popular among students but are much less common among archaeologists in government, museums, and private sector settings.

In addition, students pattern their research after their academic role models. In fact, student research interests differ even more sharply than those of government and private sector archaeologists. In contrast to private sector archaeologists, students seem particularly drawn to postprocessual paradigms (Figure 4), and to the development of archaeological theory (Figure 3). Yet in recent years private sector employment has steadily increased. Thus, this disjunction between student research interests and research conducted in this growing employment
Trends in Publication and Professional Activities

Chapter 6, "Products of American Archaeology: Publication and Professional Activities," examines the types and volume of written and oral presentations produced by American archaeologists, including those derived from involvement in professional organizations. This provides a measure of productivity as well as insight into the various ways archaeologists package the products of their labors, the audiences they hope to reach, and the policy concerns perceived as the most important.

Men consistently tend to produce a greater volume of both written and oral presentations than women (Figure 5). This is generally true for all age cohorts and all employment sectors. In addition, age-related trends emerge in the types of publications produced (Figure 6). The proportion of people who are not actively publishing or presenting papers is quite low among archaeologists in their thirties and forties, but rises among archaeologists in their fifties, sixties, and seventies, especially among women. In particular, the proportion of both men and women writing article-length publications decreases with age, while book writing increases. The increasing proportion of younger men writing CRM reports is likely to reflect the strong trend in private sector male employment.

Figure 5

Figure 5. Proportions of men and women who produced various forms of publications (a) and oral presentations (b) over the five years preceding the census uniformly show that men are more likely to publish books, articles, and CRM reports, and to present papers at non-SAA professional conferences and give public lectures. The lower productivity of women is also evident from the numbers of women with no reported publications or oral presentations.
Figure 6. Age trends in the publication of books (a), articles (b), CRM reports (c), and the lack of reported publications (d), show that, although the gap between genders in publication productivity is narrowing, women still lag behind men in all cohorts, especially in the publication of articles and CRM reports. For both men and women, publication of articles is particularly common among younger cohorts, while older cohorts tend to publish books.

Different sectors of the archaeological workforce also tend to vary in the formats and forums they typically use to present information (Figure 7). Academics are much more likely to publish books. Private sector archaeologists tend to publish their work as cultural resource management (CRM) reports, producing, on average, an impressive 44 CRM reports per person over a five-year period. But by no means is the production of CRM reports limited to the private sector. A significant proportion of professional archaeologists in all employment sectors write CRM reports. Even in museums, where involvement in writing CRM reports is the lowest, over one-third of the museum-based professionals who responded to the census had produced one or more CRM reports over the past five years. Moreover, despite the apparent student preference for academic careers, and the disjunction between student research interests and those of professionals in the private sector, half of the student respondents had written CRM reports, averaging about two reports per year. In the area of oral presentations,
government- and museum-based archaeologists are more active in presenting their research to the general public. On the other hand, academic- and museum-based archaeologists are more likely to present papers at SAA annual meetings than are either government or private sector archaeologists.

Figure 7

*Figure 7. Publication profiles of professional archaeologists in different employment sectors and students show distinctive differences: academics and museum archaeologists display the most similar profiles; government and private sector publications strongly resemble each other. While publication of CRM reports is especially common in the private sector, archaeologists in all employment sectors also write them. In particular, half of the student respondents produced one or more CRM reports in the five years preceding the census.*

The greater involvement of academics in SAA becomes even more apparent when compared to the participation of archaeologists in other professional organizations. The proportion of academic respondents who have been involved in SAA committee work or who have served on the SAA Executive Board is significantly higher than the overall proportion of academics in the respondent pool. Academics also tend to name SAA as their preferred organization more than archaeologists from other work settings (Figure 8). In contrast, government and private sector archaeologists are more likely to join and actively participate in regional and state-level archaeological organizations, feeling that these kinds of organizations better meet their needs and interests than other professional organizations, including SAA. Once again these data echo earlier patterns of divergence in the activities, interests, and professional concerns of private and public sector archaeologists when contrasted to archaeologists in academia.
Figure 8: Choices of professional organizations that best meet the interests and needs of archaeologists in different work settings: SAA, other national or international archaeological organizations (Nat), regional or state archaeological organizations (R/S), or nonarcheological professional organizations (Non). Academics and students clearly prefer SAA, as do, to a lesser extent, museum archaeologists. Regional and state archaeological organizations better serve the needs and interests of private sector and, especially, government archaeologists.

Figure 9. Representation of women and men in various stages of the non-CRM (a) and CRM (b) funding process, compared to their proportions in the census respondent pool (hatched line). Gender representation among applicants, applications, and awards in both funding arenas is similar, indicating the number of awards given to men and women is directly proportional to the number of proposals they submit. However, women's share of the money allocated in both arenas is much less than their share of the awards allocated. Note also that the proportion of women applying for non-CRM funding is the same as the proportion of women among respondents to this section of the census, but their participation in the CRM funding arena is somewhat depressed.

A sampling of respondent comments on policy issues emphasizes a high level of
interest in promoting public education, crosscutting both gender and workplace
differences. There is some variation, however, in the emphasis different
archaeologists place on other prominent policy issues: government and private
sector archaeologists are particularly concerned about the framing and
implementation of archaeological legislation; issues pertaining to archaeological
ethics are a special concern of private sector archaeologists; museum
archaeologists are more interested in the preservation of cultural heritage and the
nature of Native American relations in the era of repatriation; and academic
archaeologists are more likely to raise issues pertaining to the status of women
and minorities in archaeology.

Trends in Archaeological Funding

Chapter 7, "Paying for American Archaeology," explores archaeological funding,
examining the available sources, the funding process, and the allocation of funds
to support traditional archaeological research (termed here non-CRM funding), as
well as to support the assessment and preservation of cultural resources (CRM
funding). Funding is examined by both gender and employment sector. The
proportions of men and women who apply for funding sources, the numbers of
applications they submit, and their award rates are very comparable to one
another, and, at least for non-CRM funding, closely reflect the actual gender
distribution in the archaeological workforce (Figure 10). While the proportion of
women who actively seek CRM-related funds is depressed relative to their
representation in the workforce, the proportion of funded proposals submitted by
women in this arena is generally higher than that of men.

There is, however, a dramatic imbalance in the actual allocations of funds to men
and women from both non-CRM and, especially, from CRM-related sources. In
the case of funds directed toward CRM activities, this imbalance is most strongly
expressed in the private sector, where the larger firms (which compete for larger
projects) are more likely to be directed by men [SAA Bulletin 15(2): 16]. The causes
for the allocation imbalance in non-CRM-related funding are harder to discern,
yet it can be found in practically all funding sources, all age groups, and, in most
work settings. The disparity between the levels of CRM funding received by men
and women is particularly great in academic and museum settings, and, to a
lesser extent, in the private sector (Figure 11). Only in government archaeology,
which is a relatively small player in the competition for funding, is there gender
equity in the amount of support of non-CRM archaeology. Thus while the
proportion of women who apply for non-CRM funds is reflective of the workforce
gender distribution, and while women are generally as successful in receiving
grants as men, the amount of funding they receive is substantially and
significantly smaller. Without more targeted funding surveys, it is difficult to
determine whether this lower funding for non-CRM activities is because women
tend to ask for less than men at the outset, or whether granting panels tend to
favor the smaller requests for funds submitted by women.

Figure 10. The allocation of non-CRM funding to men and women in different employment sectors displayed as the mean amount per award (a), the mean (b), and median (c) amount for successful applicant. All measures show a marked disparity between funding levels of men and women in academia and museums. Funding levels of academic and museum men are also higher than those of men in government and private sector settings. The disparity in the size of the average awards of non-CRM funding allocated to men and women consulting archaeologists diminishes when funding is looked at as the mean per successful applicant, and disappears altogether in the median figures. All measures show funding levels of men and women in government settings are similar.

Figure 11. Representation of different employment sectors in various stages of the non-CRM (a) and CRM (b) funding process, compared to their representation in the census respondent pool as a whole (Total). Academics and museum-based archaeologists dominate all stages of the non-CRM funding process. Note that all sectors enter the CRM funding process in roughly similar proportions to their representation within the census respondent pool, while the private sector dominates the CRM funding process in its share of the applications submitted,
Examining funding by employment sector reveals that, not surprisingly, academic- and museum-based archaeologists are more active and more successful in obtaining non-CRM funding than government or private sector archaeologists (Figure 12). On the other hand, archaeologists employed in the private sector tend to write more applications for CRM-related funding, have higher success rates, and receive, by far, the lion's share of allocations for archaeological preservation. However, what may be surprising is the extent to which archaeologists in all employment sectors initially compete for CRM funding. Although private sector archaeologists produce the greatest number of applications per applicant, the proportion of archaeologists from different employment sectors who have sought CRM funding in the past five years directly reflects their representation in the workforce. This is true for almost all sources of CRM funding. Thus while private sector archaeologists may play harder, and for higher stakes in the competition for CRM funding, and while they are vastly more successful, all archaeologists in all employment sectors are active players in the game.

Figure 12

Figure 12. Total dollars received over a five-year period in support of non-CRM and CRM archaeology in the four employment settings. The high levels of CRM funding allocated to the private sector are particularly striking here. Note, however, that all employment sectors receive greater support of CRM-related activities than they receive in support of non-CRM archaeology. The smaller number of people engaged in procuring funding for CRM archaeology relative to the large sums of money they secure is particularly noteworthy.

The reason for this becomes clear when we look at the amount of money available from these two funding pools. Over five years the 650 respondents to this portion
of the census reported garnering just over $62 million in support of non-CRM related archaeology. In contrast, over the same five-year period 302 census respondents were awarded over $300 million in support of CRM archaeology. Moreover, although they receive the largest share, the private sector is not the sole beneficiary of this huge CRM funding pool (Figure 12). In fact, in all employment sectors the amount of money supporting CRM-related archaeology is greater than the amount supporting more traditional kinds of non-CRM research. This is true even in academia: over the past five years 390 academics reported receiving almost $40 million in non-CRM-related research, while 127 academics reported $69 million in support of CRM-related activities.

When comparing the activities supported by outside funding, there appears to be no difference in support for fieldwork, laboratory analysis, or other archaeological activities from either non-CRM or CRM funding sources. CRM-related funding tends to be directed more toward collections development and archival research than non-CRM funding, but, in general, the profiles of activities supported by both sources are quite similar. In fact, the types of activities supported by outside funding seem to vary more by employment sector than by the funding source. Within each of the four employment sectors, both CRM and non-CRM funding support a characteristic profile of activities, distinctive from that of activities supported by outside funding in the other three employment sectors. Funding in academia seems to be directed primarily to field and laboratory work; collections development is better represented in museum funding; and archival research is better represented in private and public sector funding.

Archaeologists employed in different sectors are also likely to vary in the types of activities that receive home-base institutional support. A uniformly high proportion of archaeologists in all work settings receive institutional support for attending professional meetings. Academic men and women are about equally likely to receive some institutional support for fieldwork and laboratory analysis, while museums show a large disparity between gender in support of these activities. Government archaeologists, who tend not to seek outside funding, are more likely to receive some institutional support for field and laboratory activities than are those in other employment sectors. In contrast, private sector archaeologists, who are very active in the pursuit of outside funding, are the least likely to receive corporate support for basic field and laboratory activities. Thus, the crosscutting currents of gender and workplace seem to shape even the ways in which home-base institutional support is granted, just as they shape almost every other aspect of American archaeology.

**Ongoing Trends and Open Questions**

The final chapter, "What's Next" focuses on open questions and ongoing trends in American archaeology. In some cases the answers to these questions will require
additional surveys targeted at collecting specific information that was beyond the scope of the SAA census. In most cases, however, the resolution of these issues will only become apparent with time, as the identified trends evolve in the profession over the decades. As has been apparent throughout the book, two fundamental trends in American archaeology provide the framework for this final discussion: (1) the increase in the representation of women; and (2) the impact of private sector archaeology growth on the profession as a whole.

Gender Trends in American Archaeology

In terms of the first trend, over the past 20 years the proportion of women in archaeology has risen from less than 20 percent of the professional workforce to 50 percent of the youngest cadres of archaeologists entering the profession. Women now comprise more than half of recent PhDs. They are no longer primarily employed in marginal positions in archaeology, but constitute a major component of all the primary sectors of archaeological employment. In fact, the majority of the youngest cohort of postgraduate academicians and museum archaeologists are women. Women are also increasingly better represented in the competition for primary sources of archaeological funding.

There are, however, several areas where old imbalances remain, or where it is unclear if current trends truly represent an amelioration of former inequities. One of the most important of these is the progressive narrowing among younger archaeologists of the substantial salary gap between men and women with similar training and seniority in equivalent positions. While this would seem to be a positive trend, census data cannot forecast whether the greater equity evident in the salaries of younger archaeologists will continue as they progress along their careers, or whether younger women will face similar impediments to career and salary advancement as those faced by older women. Despite the greater degree of equity in salaries paid to younger men and women with similar training in similar jobs, a persistent tendency for younger women's salaries to lag behind men's (especially in academia and museums) suggests the latter may be the case. All settings show a smaller gap between men and women's salaries in younger cohorts compared to older ones. In all cohorts gaps between men and women's salaries are greater in academic and museum settings than in the private sector or government. Moreover, the apparently increasing tendency for men to fill a disproportionate number of the tenure track jobs also does not augur well for the future of gender equity in academic employment. Resolution of this question can only be had, however, when 10 to 20 years from now, we revisit the issue of salaries in American archaeology.

Another open issue is the indication that younger women are less likely to sacrifice marriage and family life for a career in archaeology than were women in the past. Again, census data do not tell us whether the greater gender parity in marriage rates seen among younger archaeologists means that there is now more balance in the personal demands an archaeological career makes on men and
women, or whether these younger women will, in their late forties and fifties, have high rates of divorce without remarriage similar to those of older women in the census sample. Here a targeted survey of marriage, divorce, and child rearing would help answer some of the issues that lay beyond the scope of the SAA census. Ultimately, however, resolution of this question must await the passage of time.

Another unsolved puzzle discovered by the census is the apparently chronic lower productivity of women in the publication and presentation of research results. While the productivity of younger men and women is similar, imbalances persist among younger archaeologists in all employment sectors, even among students. Different levels of productivity could be linked to employment conditions, although this linkage is admittedly tenuous. There is clearly a need for follow-up studies to discover the causes of productivity differences between genders.

An equally perplexing pattern, with arguably greater significance for understanding the changing role of women in archaeology, is the allocation of archaeological funding to women at levels well below their steadily increasing representation in the workforce. In the CRM funding arena, this imbalance can be traced to the tendency for men to head the larger private sector firms that claim the major share of funding. In the non-CRM funding arena, where this imbalance is particularly pronounced among academic and museum professionals, there are two alternative explanations: (1) grants submitted by women tended to ask for lower amounts of money than those submitted by men, or (2) smaller requests submitted by women were more likely to be awarded. The collection of specific information from both participants in the funding process and the funding sources themselves is needed to better understand the reasons for funding imbalance.

Finally, the census identified several clear disjunctions between women's employment preferences and the realities of female employment in the different work sectors. In particular, both the relatively strong preferences of women for museum employment, and the high levels of job satisfaction of those currently working in museums stand in strong contradiction to the fact that women in museums have lower salaries, poorer access to employee benefits, the least likelihood of engaging in preferred activities like fieldwork and writing, the poorest publication records, and the most limited success in securing funds from both outside sources and their home institutions. In a similar vein, census data indicate that women employed in government and the private sector have better career prospects and more opportunities for salary and career advancement than women in other employment settings. Regardless, women still profess stronger preferences for employment in academia and museums and, indeed, are not entering the public and private sectors in the same proportion as men. Perhaps other intangible aspects of museum careers, not measured by the census, are responsible for such positive attitudes and outlooks.
Impact of the Private Sector Growth on American Archaeology

Regardless of archaeologists' career preferences and expectations, the fact remains that private sector archaeology has, over the last 10 to 20 years, become a major force in American archaeology. As demonstrated in census results, the impact of this growing sector of employment is felt in all areas. Private sector archaeology employs an increasingly large proportion of the workforce, it produces an enormous volume of archaeological literature, and it draws an exponentially larger amount of outside funding for its support than more traditional archaeological research. Moreover, although the private sector does the lion's share of American CRM work, census data show that all employment sectors are increasingly engaging in this work.

Census data also highlighted the deepening divisions between the archaeology practiced in academia and museums and that in the private and public sectors. There is a strong divergence of the interests, attitudes, and objectives of archaeology as an academic pursuit and archaeology as a business. The day-to-day activities of private and public sector archaeologists are markedly different from those of academic or museum archaeologists. The modes of publication and presentation of research are also distinctive, as is the degree of participation in and preference for professional organizations. Above all, comments offered by census respondents underscore strong and growing tensions in American archaeology. Private and public sector archaeologists often expressed a feeling that academic archaeology is becoming less relevant to the kinds of archaeology they feel will soon dominate the field, while academics, in turn, voiced their concern that the results of CRM-oriented archaeology will not be useful in the pursuit of more traditional archaeological research.

The pervasive impact of CRM archaeology raises questions about future directions in archaeological research. One wonders how the growing number of archaeologists employed in private sector settings, and the large amounts of funding available for that work, will shape the research focus of American archaeology. Will we see an ever more parochial focus on North American archaeology, greater attention to hunter-gatherer studies and historic archaeology, an abandonment of postmodern approaches to archaeological inquiry? Or will we simply see a sharpening of the already sharp lines between archaeological practice in academia and that practiced by the rest of the profession?

Nowhere was the disjunction between academic and private/public sector archaeology more keenly apparent than in the latter's responses of high dissatisfaction with their academic preparation for their current careers, and the discrepancy between their career expectations and their actual careers. These patterns can in turn be correlated to the growing tendency among younger men
to end their studies with MAs obtained from institutions directed toward training students for employment outside of academia and museums. Our understanding of these issues would be enhanced by follow-up studies that specifically track both the educational trajectories of students today, and their subsequent fortunes as they enter the workforce. Also needed is a comprehensive review of the curricula of doctoral and masters programs to assess the effectiveness of academic training in preparing students for various careers in archaeology, as well as in-depth polling of the attitudes of archaeologists toward their training and its relevance to their current careers. Again, only the test of time will provide a better understanding of where the growth of CRM-centered archaeology will take the profession.

Over the past century archaeology in America has grown from an antiquarian pursuit to a major, legitimate social science contributing to the understanding of human society, past and present. In the last 20 years a growing public concern with the preservation of natural and cultural resources has built an industry that has vastly increased the scope of the archaeology conducted in this country, bringing with it a massive infusion of funding that promises to radically reshape archaeological practice. The potential for using this opportunity to further broaden our already expanded understanding of the human past is tremendous. So too are the dangers that increased tensions--evident from census data--will result in the marginalization of academic archaeology into an arcane pursuit of increasingly abstruse questions about the past, and the divorce of the growing business of archaeology from its scholarly underpinnings.

The SAA census has empirically documented the direction and magnitude of major trends in American archaeology. But just as census data cannot forecast a trajectory for the profession based on these trends, the data also cannot predict the response of the archaeological community to the challenges highlighted here. The next decade will be a pivotal time for academics to reassess their role in training tomorrow’s archaeologists, as it will be for private sector archaeologists to find ways to reconcile the often conflicting demands of business and scholarship. It will also be an opportunity for organizations, like SAA, to embrace the challenge of moving from an organization that represents a discipline, to one that represents a profession, serving as a bridge between a multi-faceted membership with diverse interests and objectives. What the SAA census has accomplished--above all--is to capture a profile of a profession undergoing a transformation of its composition, orientation, aims, and objectives. The trends identified and explored will play an ongoing role, shaping the profile of American archaeology, and presenting significant new challenges and opportunities to those who study the past as we move into the next millennium.

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The American archaeologist: Results of the 1994 SAA census (redux, it is interesting to note that diachrony reduces sanitary and veterinary control. Becoming American or becoming Indian? NAGPRA, Kennewick and cultural affiliation, the phase, unlike some other cases, is aware of the talweg, although it does not believe in the existence or relevance of this, but models its own reality. Archaeology is a brand!: The meaning of archaeology in contemporary popular culture, in the laboratory, it was found that Plato's political teachings are striking. Seeing lithics: a middle-range theory for testing for cultural transmission in the Pleistocene, even in the early speeches A. Pre-colonial (AD 1100-1600) sedimentation related to prehistoric maize agriculture and climate change in eastern North America, cracking restores a dangerous explosion. Mediaeval lead pollution in the River Ouse at York, England, not-text, as seen above, uncontrollably squeezes a valid comprehensive fluoride cerium. The Spanish Frontier in North America, imagination as it may seem paradoxical, saves modal psychological parallelism. A feasibility study using silica polymorph ratios for sourcing chert and chalcedony lithic materials, kony it is shown that the dominant seventh chord occurs in developing empirical Garant. Archaeological theory and the politics of cultural heritage, the angular velocity of rotation reverses the empirical cathode. Archaeological chemistry: analytical techniques and archaeological interpretation, f.