APPLICATION FOR A REGULAR GRANT-IN-AID FROM THE WENNER-GREN FOUNDATION FOR ANTHROPOLOGICAL RESEARCH, INC.

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1. Name of applicant (underline surname/family name):
Christopher Carr

___ Ms.
___ Mr.
_X_ Dr.

Address of applicant:
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2. Title, department and institutional affiliation:
Assoc. Professor
Dept. of Anthropology
Arizona State University
Tempe, AZ 85287

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3. Date and country of birth: May 10, 1988 United States of America

4. Highest academic degree: Ph.D Year and institution: 1979 University of Michigan

Field of degree: Anthropology

5. Title of project:
Modeling the Evolution of Alliance Stategies as Systems Regulators in Egalitarian Societies

6. Total amount requested in U.S. Dollars:
$ 7956.

7. Summary description of project:

A theory of "ordered sequences of development" of alliance mechanisms in the evolution of egalitarian societies is proposed. The theory is based on general systems principles. It considers the trade-off between the energy efficiency and structural commitment of alternative alliance strategies in predicting their enactment in landscapes of increasing natural or social risk. The strategies include reversible economic transactions and political agreements, longer-term social structural commitments, and sanctified agreements of a perceived eternal order. As an initial test, the developmental patterns of two specific alliance mechanisms--utilitarian exchange and valuables exchange--will be traced over 1800 years of prehistory in southern Ohio, which encompasses a broader sequence of alliance developments. Analysis will focus on the exchange of ceramic vessels, which will be documented with data on their clay chemistry and temper mineralogy and the chemistry of natural clay sources (electron microprobe and petrographic methods). The research will bridge current ethnological and archaeological approaches to alliance formation by addressing both particular behavioral strategies and long-term diachronic change, as opposed to measuring changes in only "social interaction in general." Also, exchange will be measured on a continuous rather than discrete-period time scale.

8. Beginning date and estimated duration of the phase of the project for which support is requested:
January 1, 1989 - December 31, 1989

9. Does project include field work?
yes ___ no _X_

10. Location where project is to be carried out:
Arizona State University

11. Are special permits or approvals needed for project?
yes ___ no _X_

Have they been obtained? yes ___ (Append)
no ___

12. Other personnel participating in project:

13. Names of References (DO NOT REQUEST LETTERS):
Prof. David P. Braun, Dept. of Anthro., Northern Arizona University, Flagstaff, AZ 86011.
Prof. William S. Dancey, Dept. of Anthro., Ohio State Univ., Columbus, OH 43210

14. Aim and scope of project:

Aim. From an ecological perspective, one of the fundamental problems in the study of human adaptation and evolution is the development of regional and local cooperative networks, or "alliances," in egalitarian societies (Braun and Plog 1982). The proposed research aims at testing a theory on the pattern of evolution of alliance strategies. The theory marks an advance in that it deals with the specific behavioral tactics used to establish and escalate alliances rather than "overall social interaction," which has been the focus of archaeological studies. Consequently, the work bridges sociocultural anthropology and archaeology.

Theory. It can be argued that in landscapes of increasing economic, social, or other risks, alliances mechanisms in egalitarian societies develop in a regular way. The essential features of this pattern are found among all adaptive systems. Systems adapt to their environment through "ordered sequences" of mechanisms. A system's initial responses to environmental perturbations are achieved through behavioral rather than structural modifications. These are costly in activity and energy expenditure but, being structurally noncommital, allow the system to retain evolutionary flexibility. As perturbations continue and become more predictable or intense, adaptation is accomplished through structural changes. These release the system from costly behavioral responses but commit it to a narrower range of future adaptive options (Slobodkin and Rapoport 1974).

Patterned in this way, alliances would (1) be initiated with reversable economic transactions and political agreements, (2) escalate to longer-term social structural commitments, and (3) culminate in sanctified regulatory agreements of a culturally-perceived eternal order. Some specific mechanisms that could be involved in the sequence, and that are known to occur ethnographically, include: exchange of easily replaced utilitarian goods; exchange of more valuable, less easily replaced items; broadening networks of cooperation organized around Big Men; intermarriage between communities; and burial of the dead from different communities in a common cemetery (e.g., Malinowski 1922; Chagnon 1983; Rosman and Rubel 1971; Trigger 1969; Brown 1982). In this sequence, the mechanisms shift from energy expensive and structurally noncommital, to more energy expensive and structurally noncommital, to finally energy efficient but structurally permanent and constraining.

Test and Scope. To provide an initial test of this theory, in preparation for its more extensive evaluation, two alliance mechanisms will be tracked for their intensities and spatial patterns over a complete prehistoric sequence of alliance intensification. These are: "utilitarian exchange," as exemplified by the trade of utilitarian ceramic vessels, and "valuables exchange," as exemplified by the trade of more finely finished serving/domestic ceremonial vessels and mortuary vessels. The region and time period that will be examined is southern Ohio during the "Woodland Period" (600 B.C. to A.D. 1200), especially the Scioto-Licking Valley area (Fig. 1).

Archaeological data from this space-time unit and the Midwest U.S. in general suggest that it is very appropriate for study (see p. 3). It witnessed a complete sequence of alliance developments, from simply the exchange of utilitarian items and raw materials (Late Archaic - Early Woodland), through the exchange of valuable items and the development of Big Men networks (Early Woodland), to what appear to be cooperative arrangements that were sanctified through mortuary rituals (Middle Woodland). Thereafter, structural adaptive mechanisms stronger than alliance relations (population nucleation and perhaps sodality organizations and ethnic consol-idation) appear to have modified or supplanted previous behavioral and structural alliance mechanisms. (Aument 1988; Brown 1982; Church 1987; Dancey 1986). The Ohio Woodland sequence is also critical as a benchmark for Eastern U.S. culture history.

Test Implications. If the proposed theory is correct, one would expect (a) increases and decreases in the absolute rates of exchange of utilitarian and fine wares over the Woodland, (b) increases and decreases in the spatial scale of exchange, and (c,d) a lag-lead pattern in the relative rates and scales of exchange of the two vessel types.

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15. Outline of methodology:

Data Base. The four expected exchange patterns will be sought with a sample of sherds from 250 representative vessels from 23 sites in the Scioto-Licking area (Table 1). Vessels are well dated (80+ radiocarbon assays) and distributed over time so that exchange can be tracked on a time-continuous rather than discrete-period basis. Each sherd is known to belong to a different vessel from previous radiographic studies. Fine-grained vessel identification and dating were supported by NSF. The sample size will allow average regional absolute frequencies of vessel trade to be reconstructed within 4% and relative frequencies within 8%, plus sampling error.

Method. Each vessel will be characterized as to whether it was made locally or imported, and if imported, its general geographic source. Trade vessels and sources will be identified with routine procedures (Bishop et al 1982). (1) The clay chemical composition of vessels will be compared to the known compositions of 322 natural clay sources at scattered locations over Ohio. (2) The clay chemical compositions of vessels from the same site will be compared to each other. (3) The mineralogy of rock temper inclusions in vessels from the same site will be compared. Vessel clay chemistry (% 13 elements) will be determined by electron microprobe using procedures developed and tested by me over the last 2 years for Ohio pottery. Temper minerology will be identified petrographically. The feasibility of identifying trade vessels and their sources is suggested by a small pilot study. Ca, Fe, P, S, and K were found to distinguish both the clays of 20 utilitarian vessels from 9 up-river and down-river sites and natural clays in different geomorphological regions of Ohio. Petrography has shown the Woodland ceramics to be well differentiated mineralogically.

Schedule. Laboratory data will be collected from Jan. through Sept. 1989. Statistical and time-series analyses and a final report will be completed by Dec. 1989.

16. How does the project relate to other research on the topic or problem, and how will it contribute to anthropology?

The proposed project will contribute to (1) general anthropological theory on alliance formation and exchange, (2) archaeological method (see above), and (3) substantive understanding of Eastern U.S. culture history. Theoretically, the development of social networks of cooperation is important from the perspectives of ecology and evolution (Jochim 1981); formal, substantive, and political economics (Bohannan 1955; C. Gladwin 1975; Leacock and Lee 1982; Mauss 1954; Rubin 1975; Sahlins 1972; Wiessner 1982); and social structure and process (Chagnon 1983; Eggan 1964; Foster 1979; Mitchell 1974). Within the ecological paradigm, the central and multifunctional roles of cooperative networks in human and cultural adaptation and evolution are clear: they have served to level out subsistence risks among groups (Braun and Plog 1982), to distribute and balance human population over landscapes (Rappaport 1971), and to improve political security (Chagnon 1983). Their intensification and the shift in their general nature over time marked the transition of egalitarian societies into complex ones (Brumfield and Earle 1987; Flannery 1974; Renfrew and Shennan 1982; Wright 1977). The theory of alliance development examined here integrates each of these ecological concerns.

The project will bridge ethnological and archaeological approaches by addressing both the diachronic evolution of alliance networks and the particular behavioral strategies by which networks are created. In contrast, ethnological studies have typically been largely synchronic and focused on the dynamics and function of particular alliance strategies, wheras archaeological studies have been diachronic but measured only nonspecific "interaction in general" or trade (references above).

Substantively, the research will complement and refine other recent archaeological studies pertinent to network development in the Midwest U.S. and Ohio. These include (1) broad, qualitative outlines of social interaction and its environmental determinants (e.g., Brown 1977, 1982; Brose and Greber 1979; Ford 1974; Farnsworth 1986); (2) quantitative studies of "social interaction in general" using pottery style similarities among communities (Braun 1977), (3) quantitative studies of expanding mating networks using skeletal data (Buikstra 1977), and (4) environmental, subsistence, health, and demographic reconstructions, which quantify "risk" (Fischer 1974; Perzigian et al 1984; Wymer and Pacheco 1987; Yarnell 1983).

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17. Budget itemization: List the major categories of expenses for which funding is requested. If budget justification is required, attach addendum sheet (see instructions).

Electron microprobe laboratory time:	$1087.
Electron microprobe technician time:	$1269.
Petrographic thin section preparation:	$1025.
Petrographic mineral identification and measurement:	$1875.
Key entry of data:	$ 125.
Research assistant for statistical analyses:	$2575.
TOTAL	$7956.

(See budget justification for each category.)

18. Other sources of aid received or expected for project described in this application:

None.

19. Sources of aid received for other phases of project:

Funding of preliminary stages of work (see vita for full reference):

1987d	Arizona State University.	$ 2,528.
1986a	National Science Foundation. (a portion of this)	$58,700.
1986e	Arizona State University.	$ 370.
1986f	Arizona State University.	$ 607.

Numerous other grants between 1982 and 1987 have allowed methodological developments and ceramic dating pertinent to this work.

20. What language skills does the project require, and how do you rate your competence? If other special skills are relevant, state what they are and how you rate your competence.

Technical analysis of microprobe and petrographic data for the purposes of this project minimally requires competence in (1) statistical methods for segregating microprobe noise from stable elemental information, (2) time series statistics for modeling change and lag-lead relationships, (3) ceramic technology and clay chemistry, and (4) basic geomorphology and geology for selecting relevant clay compositional and petrographic variables. I have worked in each of these areas from 6 to 18 years (see grants and publications in vitae). I have authored one book with extensive sections on clay chemistry and time-series analysis (Carr 1982) and edited a second on quantitative methods (Carr 1985). Over the last two years, I have tailored microprobe lab techniques and petrographic data collection to the specific ceramics to be studied.

21. How does the project relate to applicant's prior work and/or future plans?

I have carried out and will continue a multi-project research program on the evolution of egalitarian and rank societies in prehistoric Ohio. (1) A continuous-scale, fine-grained chronological framework for Ohio is being developed, using ceramic technological changes (temper density, size; wall thickness) and TAMS accelerator dating. (2) New x-radiographic methods have been developed to document temper parameters and to isolate sherds from individual vessels. (3) Stylistic analyses of mortuary weavings from Middle Woodland sites in Ohio have been made to reconstruct sociopolitical units and estimate their participation in mortuary rituals as alliance mechanisms. (4) An EDX spectrometry analysis and review of Middle Woodland meteoritic iron artifacts has been made to study pan Eastern U.S. Woodland exchange patterns.

22. Have you ever applied for a Wenner-Gren Foundation Grant? yes ____ no X

Was it awarded? yes ____ no ____ Grant # _____

What is its relationship to this project?

BUDGET JUSTIFICATIONS

1. Electron microprobe laboratory time. Microprobe analyses will be done in the Arizona State University Microprobe Laboratory, a subsidized laboratory, with a cost savings of approximately $25/hr, or .725 sherds/hr x 250 sherds = 181.25 hrs @ $25/hr = $4531.25 savings. The funds requested here will be:

.725 sherds/hr x 250 sherds = 181.25 hrs @ $6/hr = $1087.50

2. Electron microprobe technician time.

.725 sherds/hr x 250 sherds = 181.25 hrs @ $7/hr = $1268.75

3. Petrographic thin section preparation. Thick sectioning of sherds in preparation for thin sectioning has already been completed as part of a related National Science Foundation project on ceramic technology and dating. The cost savings to this grant is $4.34/sherd x 250 sherds = $1085. Thin sectioning will be done at a bulk rate by Quality Thin Sections, Tucson at the cost of:

$4.10/sherd x 250 sherds = $1025.00

4. Petrographic mineral identification and measurement. Standard petrographic techniques with a polarized light microscope will be used for mineral identification. Point count methods and sterologic principles (Bishop et al 1982) will be used to characterize each sherd by the percent volume of temper particles of ca. 18 mineral classes for particles of all sizes and for particles of certain size classes, on both a particle volume basis and particle plus matrix volume basis. Also, particle rounding and frosting will be recorded. These tasks will be done at the Ceramic Petrographic Laboratory, University of Arkansas, Fayetteville, under the direction of Prof. Jerome C. Rose, at approximately 50% typical academic costs ($937 savings). The cost of this work will be:

1.25 hrs/sherd x 250 sherds = 312.5 hrs @ $6/hr = $1875.00

5. Key entry of data.

25 hrs @ $5/hr = $ 125.00

6. Research assistant for statistical analyses. With appropriate data screening, sourcing of vessels will be achieved with multidimensional scaling and discriminant function analysis. Exchange frequencies, distances, and lag-lead relationships patterns will be modeled with simple descriptive statistics and time series analysis. A post-MA student in anthropology, with a concentration in quantitative methods and graphics in archaeology, will help in these tasks. It is estimated that the research assistant's work will take 18 weeks at 13 hrs/week. The costs of this work, using a pay scale similar to assistantships at Arizona State University, will be:

235 hrs x $11/hr = $2575.00

Cost savings. The total amount of funds that will be directly contributed to by other sources to the research proposed here will be approximately $6553 = $4531 (microprobe) + $1085. (thick sectioning) + $937. (petrography).

The preliminary work which led to this proposal was funded primarily by a National Science Foundation grant (#BSN-8604544). This made possible the selection, radiographing, and dating of the sample of sherds to be used here and involved a 9 month research stay in Columbus Ohio (Total grant = $58,700). Documentation and analysis of natural clay chemistry variation in Ohio, initial exploration of Ohio ceramic clay chemistry variation, and development of electron microprobe laboratory procedures suited to the Ohio ceramics, were supported by three grants from Arizona State University totalling $3505.

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TABLE 1

TEMPORAL AND SPATIAL DISTRIBUTION OF DATED ARCHAEOLOGICAL SITES AND VESSELS WHICH ARE AVAILABLE FOR STUDY

Time Period	Upper Scioto-Licking Area		Lower Scioto Valley	
	Sites	No. of Vessels	Sites	No. of Vessels
Early Woodland	Dominion Land Co.	30	Florence	14
	Smith	31	Continental Construction	2
	Locust	14		
	Galbreath	3	Dresback	4
	Toephner	1		
Middle Woodland	Murphy	19	McGraw	61
	Decco	9	Harness-28	24
	Newark Campus	11	Mound City	48
			*Edwin Harness	4
			*Seip	9
Early Late Woodland	Scioto Trails	57	Harness-28	45
	Waterplant	43		
Late Late Woodland	Decco	10	Continental Construction	1
	Greencamp	3		
Fort Ancient	Cole	15	Howard Baum	24
	Voss	68	Blain	43

TOTAL NUMBER OF SITES = 23

TOTAL NUMBER OF VESSELS = 593 **

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* Available for nondestructive microprobe analysis, only. Petrographic analysis is not permitted.

** Only 250 of the 593 availabe vessels will be examined for the proposed preliminary work. The 593 vessels are a representative subsample of a much larger set of Woodland vessels (1200+) which have been dated and documented for their morphology and technology.